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TROPICAL

DYSENTERY AND CHRONIC DIARRHŒA

LIVER ABSCESS — MALARIAL CACHEXIA — INSOLATION

WITH OTHER FORMS OF TROPICAL DISEASE

AND ON

HEALTH OF EUROPEAN CHILDREN AND OTHERS IN INDIA

BY

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ETC. ETC. ETC.

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TO

SIR WILLIAM MUIR MUIR, K.C.B., M.D.

HONORARY PHYSICIAN TO THE QUEEN

DIRECTOR-GENERAL ARMY MEDICAL DEPARTMENT

THIS VOLUME

ON TROPICAL DISEASE

Is Dedicated

IN TOKEN OF THE

AUTHOR'S SINCERE REGARD AND ESTEEM

M350971

PREFACE.

This volume consists of Lectures and Papers that have, from time to time, been read, or have appeared in the medical journals.

Those on Tropical Dysentery and Chronic Diarrhœa were the Lettsomian Lectures of 1881, and are published in accordance with a desire expressed by the members of the Medical Society of London, before whom they were delivered.

The subjects are treated clinically. The descriptions of Dysentery, Diarrhœa, Liver Abscess, and Cachexia will, I hope, be useful at home as well as abroad, for the chronic forms and sequelæ of these diseases are frequently met with in England.

I desire to record my sincere thanks to all who have assisted me to prepare these Papers.

London, *July*, 1881.

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TROPICAL DYSENTERY AND DIARRHŒA.

LECTURE I.

Mr. President and Gentlemen,

When the Council of this Society did me the honour of inviting me to deliver the Lettsomian Lectures this year, I hesitated to undertake the duty, as I did not feel assured that I possessed sufficient special knowledge of any subject to justify me in appearing as a lecturer before an audience of such large and varied experience as that of the Medical Society of London; but, on reflection, it seemed to me that I might, without presumption, fulfil the object of the founder of these lectures, and at the same time turn the experience gained during my service in India to account, by submitting some practical observations on certain forms of disease which, whilst common in that and other tropical and sub-tropical countries, are not unknown here in their chronic forms; and this seemed the more appropriate, because the sequelæ of the diseases I propose to describe are to be observed in our own country as well as in the tropics, in the case, chiefly, of persons who, returning from India, China, or the Colonies, are gradually becoming more numerous, and consequently more interesting to medical men at home.

The subjects, therefore, that I have selected are dysentery and diarrhœa, as observed in their acute and chronic conditions in India and the tropics, and in their chronic stages, and consequent visceral lesions, which are met with at home,

and are frequently the cause of serious deterioration of health, protracted suffering, and occasionally of death; the treatment and management also being often tedious and difficult—an assertion that I believe will be borne out by medical men who have been brought in contact with a class of cases which may now be met with in almost every part of the United Kingdom and at continental health-resorts; for, almost daily, invalids are returning to Europe in quest of recovery from this or some other form or sequel of climatic disease. The influence of change of climate on the progress and termination of these complaints is a subject of considerable interest, and well worthy of consideration; for our rapidly extending relations with India, China, Africa, and other foreign countries, and the consequent increased intercommunication, facilitated by improved means and channels of intercourse, are causing closer approximation of interests, and are bringing home to us also in this country the importance of the part played by climate in regard to its effects on the health of Europeans, not only in respect of their fitness to encounter its influences, but as regards the probabilities of future health for those who are compelled, in the course of duty or business, to return to the country in which they have already suffered. From this point of view I think the subject may be of interest to the members of this Society, whose indulgence I ask whilst I endeavour to lay before them some observations, which, being the outcome of personal experience, will not, I trust, be devoid of interest.

In the course of my remarks I shall have to speak of much that relates in common to dysentery and diarrhœa; but that which is peculiar to each will be considered and described separately as I proceed.

Historical Retrospect.

In the ancient system of Hindoo medicine of the Ayurveda and the commentaries of Dhanwantari, Charaka, and

Sussutra, which carry us back nearly 3,000 years, and in later Sanscrit writers, dysentery is described by the name of Atisar, under two forms—Ama-apaka, or acute, and Pakitsar, or chronic; these again are subdivided into six varieties, ascribed by those ancient sages to changes in air, bile, phlegm, food, or to perturbations of the emotions and passions; whilst the symptoms and treatment are detailed according to their notions of disease.

Herodotus refers to it in his writings; Hippocrates described it and gave it the name of "Dysenteria," by which it is now known. Thence to the close of the sixteenth century by Greek, Roman, Arab, and later by numerous writers down to our own day, medical literature abounds in descriptions of the disease, some of which, even by the Fathers of Medicine — Aretæus, Celsus, Galen, Cœlius Aurelianus, Alex. de Tralles, and others,—are so precise as to leave little to modern description; showing, too, that it had even then, according to the knowledge of the time, been the subject of careful clinical observation and pathological research. My object being a practical exposition of some of its clinical aspects, I shall not attempt any detailed historical account of the disease, or do more than indicate some of the most important authorities, especially those who in recent times have added so much to our knowledge of its treatment.

Until after Hippocrates, the term dysentery was applied to other diseases accompanied by discharge of blood from the bowels; but early in our era it began to be restricted to a single disease, which was ascribed to a variety of causes—acid bile, acrid secretions, and so on—whilst bloody stools, mucus, and ulcerated bowels were recognized as its characteristics. The views of the classic writers — Cœlius Aurelianus, Archigenes, Aretæus, Galen, and Alex. de Tralles —continued to be held down to the time of Fabricius and Fernel (the modern Galen), in the seventeenth century, about which period new opinions began to obtain as to causation and classification, whilst the experience of frequent epidemics gave opportunity for further investigation into the

nature and origin of the disease. The writers of the seventeenth century are numerous; among them Bontius, Boerhaave, Arnold, Chouet, Willis, and Sydenham, who studied it during the London epidemic of 1669-72, and regarded it as intestinal irritation produced by a fever localized in the large intestine, are conspicuous. In the eighteenth century the writers are more numerous still, whilst knowledge of the disease was increasing, with more frequent opportunity of studying it. Stoll, Pringle, Morgagni, Zimmerman, Degner, Lind, Gilbert Blane, and many others have left faithful descriptions of dysentery in all its forms, and various theories as to its origin. In the present century, and notably during the last twenty-five years, marked progress has been made, especially in the method of treatment.

The writers are too numerous to mention, and I would simply say that to them we are indebted for more accurate knowledge of the pathology and therapeutics of dysentery as a specific disease. Desgenettes, Rollo, Annesley, Baly, Cruveilhier, Bamfield, Parkes, Hirsch, Bleker, R. Martin, Morehead, Docker, Chevers, Macpherson, Goodeve, Ewart, Aitken, and Maclean have done much by their teaching or writing to advance our knowledge of the subject. I might, did time permit, cite many others, but these are sufficient to show that a copious literature of dysentery, from the earliest down to the latest times, exists.

Though now chiefly a disease of tropical and sub-tropical climates, it neither is, nor has been, restricted to such geographical limits. It may appear sporadically anywhere, and has prevailed wherever men have congregated under certain unfavourable hygienic conditions of climate, locality, food, drink, and occupation, often in the form of severe and destructive epidemics. Few parts of the world, except the polar regions—and I am not sure that they are an exception—have been exempt from it. Accounts of its ravages in various regions abound in the authors I have mentioned.

Since the account of it by Herodotus as it affected the Persian army in Thessaly, down to the present day, it continues to be a source of danger and weakness to armies, camps, garrisons, and fleets, and also to the general population. It was as destructive to our men at the siege of Harfleur and at Agincourt, in 1415, as it was in the Crimea in 1854, or in Afghanistan in 1879.

Fernel says that in 1538 it was so general throughout Europe that neither village nor town escaped, notwithstanding that the seasons had been regular.—(Copland's "Dictionary.")

The Plague of London of 1665 was followed in the autumn of 1666 by an epidemic of dysentery, which was infectious, and was considered to have been due to contamination of the air by the plague victims buried in and about London the previous year.—(Copland's "Dictionary.") Other epidemics of it visited London in 1669-72, in 1762, and 1768.

No part of Europe, from Spain to Norway, seems to have escaped. Two hundred years ago it was most prevalent and fatal in London. It prevailed in Ireland in 1722, during times of scarcity of food, and on subsequent occasions, when it has been a scourge to that island, as in 1846, and always of an adynamic type. France suffered from epidemic dysentery in 1859. Melbourne, in Australia, was ravaged by a severe epidemic in 1853 to 1855. Norway suffered in 1859. It is noticeable that it apparently visits European countries with less severity now than in past times. Two centuries ago it was as great a scourge in England and throughout Europe as it is now anywhere in India; but with the progress of civilization, amelioration of the conditions of living, improvement in agriculture, reclamation of waste and uncultivated lands, better surface and subsoil drainage, paving of towns, better dwellings and food, and purer drinking-water, it has gradually diminished, or has so nearly disappeared, in this country at least, that few whose experience is confined to our own islands have had the opportunity (beyond an occasional sporadic case) of seeing it either in the acute form, or as an epidemic. How far the extinction of dysentery

is due to improved hygiene and ameliorated conditions of living, I cannot say, but it seems as though they stood to each other as cause and effect. Like malarial fevers, with which it has close affinity, it has almost disappeared from our tables of sickness and mortality. Doubtless, were conditions like those that developed it in Millbank in 1825, or that recorded by Clouston in 1865 as having occurred in the Cumberland and Westmoreland Asylum, in which scorbutic dysentery, due to effluvia from sewage, accompanied by a bad diet, defective in vegetable matter, affected the inmates, again to occur—a state of things now, we hope, impossible—we should again have similar dire results. But it seems improbable in these days of sanitary reform that such should be the case, or that an epidemic of dysentery should again desolate London like that described by Sydenham, which proved that our northern latitude is no safeguard when local insanitary conditions foster and favour the spread of the disease, such as may have been the case even so late as the middle of last century, when the death-rate of London from all causes was one in *twenty-four* of the population, though even then the public health was improving, and the average duration of human life was slowly increasing. It is now one in forty-four or forty-five, and there is no reason, except opposition to, or want of faith in, hygiene, why it should not be much further reduced.

Dysentery has always had peculiar interest for the naval and military medical officers, for it is in their special field of operation that it has caused the severest ravages, as the history of our own and continental military and naval campaigns can tell. In Napoleon's Egyptian campaign twice as many men died of dysentery as of plague—*i.e.*, 2,468 of dysentery, 1,689 of plague. Dewar graphically describes the sufferings of the British Army in the same campaign. Desgenettes says it killed more soldiers between 1782 and 1815 than fell in action in the great wars of the empire. The British Army in Holland in 1748; the Walcheren campaign of 1809; the Peninsular campaign, in the

Talavera campaign Kinglake says [vol. vi., appendix, page 473, "Invasion of the Crimea"], "The troops in great numbers fell sick, went into hospital, and died from want of necessary succour; from dysentery alone 5,000 men died"; Napoleon's wars; the Crimean campaign, where between October 1, 1854, and March 31, 1855—six months—our army had 48,742 cases of sickness,* exclusive of wounds, and of these 18,708 were diarrhœa, 4,441 dysentery; the Franco-German, the Russo-Turkish, and the Civil war of 1861 to 1863 in America, when one-fourth of all the disease was dysentery or diarrhœa, with a mortality of 12·36 per 1,000 (Clymer), attest the fact that dysentery is one of the greatest difficulties armies have to encounter even in temperate climates, and how much it is attributable to defective food, bad hygiene, and climatic vicissitudes; whilst Indian, Burmese, African, and Mexican campaigns declare its severity in tropical climates.

Sir R. Martin says, "It is the disease of the famished garrisons of besieged towns, of barren encampments, and of fleets navigating tropical seas, where fruits and vegetables cannot be procured. During the Peninsular, the first Burmese campaign (and I may add the second also), and the late war with Russia, dysentery was one of the most prevalent and fatal diseases which reduced the strength of the armies engaged"; and I purpose to show you that it proves most destructive in India, its prevalence and fatality there depending apparently on climatic influences and defective hygiene, and that, like fevers, it bears a marked relation to the prevalence of malaria.

I have referred to it as a disease of tropical or subtropical latitudes, but have already said that sporadic cases occur everywhere, while severe epidemics have appeared in northern latitudes. As it is endemic and most prevalent in hot countries, and especially in India, I shall confine my remarks mainly to experience derived from that country, and, as the time at my disposal is limited, I shall, after a

* This was exclusive of cases treated at Scutari. The deaths were—dysentery 696, diarrhœa 1,303.

brief reference to its distribution and prevalence in those countries, proceed to consider it in its etiological, clinical, pathological, and therapeutical bearings. Let me, then, ask your attention to its prevalence in those parts of the world where our troops and sailors are serving. The information is gathered from the official reports, and includes also the gaol and some part of the civil population, which, from the circumstances under which they are framed, supply data that may be regarded as reliable. I have said but little as to the incidence or fatality of dysentery in past or even in recent times, though sufficient to direct attention to the universal character and prevalence of the disease. I propose, however, to enter a little more into detail in regard to India, as I wish to bring you face to face, as it were, with the complaint as it now occurs in a large portion of our dominions.

As regards diarrhœa, I shall include it with dysentery in the statistical returns, and shall conclude what I have to say in the third lecture with some clinical remarks on the pathology and treatment, especially of the chronic form of the disease—to which, indeed, my remarks will be chiefly confined—so frequently seen in old residents of tropical climates, and which seems to be so nearly allied to dysentery.

Geographical Distribution and Prevalence in India and other Foreign Stations.

Official returns for 1878 show that in the European Army of India, with an average monthly strength of 56,475 men, there were in that year 2,784 cases of dysentery and 3,972 of diarrhœa; of the former 98 and of the latter 4 cases proved fatal, or 1·73 and 0·7 per 1,000. The greatest prevalence (314) occurred in September, the lowest (186) in March. There were 49·3 cases of dysentery and 70·3 of diarrhœa per each 1,000 of strength; whilst 3·52 of dysentery and ·10 of diarrhœa died of each 100 treated; 125 were

invalided for dysentery and 30 for diarrhœa, or 2·75 per 1,000 of strength. Of 5,170 European women connected with the European regiments, there were 164 cases of dysentery, of which 7 were fatal; and 299 cases of diarrhœa, of which 8 were fatal—1·35 of dysentery and 1·55 of diarrhœa per 1,000 strength. Of 10,423 European children, there were 289 cases of dysentery and 1,033 of diarrhœa; 40 of the former and 149 of the latter, or 3·84 and 14·30 per 1,000, were fatal. In the Native army of 117,272 men there were 9,622 cases of dysentery and 4,747 of diarrhœa; 191 of dysentery and 112 of diarrhœa proved fatal, or 1·63 and ·95 per 1,000 respectively; 82 per 1,000 of strength were admitted for dysentery, and 40·5 for diarrhœa.

Of a gaol population of 127,914 persons, chiefly natives, there were admitted 14,487 for dysentery and 12,998 for diarrhœa. Of these 2,326 proved fatal from dysentery, 1865 from diarrhœa—being a fatality from both combined of 32·76 per 1,000, or of 15·25 of each 100 treated.

Comparative statements show the relative prevalence and mortality of the diseases in different parts of India, and that dysentery is more severe in Madras than in the other Presidencies. I have taken these details both from the European and Native returns, to show the extent of its prevalence among the native population, the seasonal prevalence, as well as a comparison with fever.

The extent of seasonal variation of prevalence in the hill-stations is noted, and it will be seen that, although less severe, the disease occurs at those elevations of from 4,000 to 8,000 feet above the sea-level. It must be remembered, however, that the seeds of the disease may have been carried up from the plains.

COMPARATIVE STATEMENT OF THE RATIOS OF SICKNESS AND MORTALITY IN THE EUROPEAN ARMIES OF THE THREE PRESIDENCIES FOR THE YEAR 1878.

For the year.	Ratio per 1,000 of strength.			
	Army of Bengal.	Army of Madras.	Army of Bombay.	Army of India.
Admission-rate :				
Dysentery	39·7	93·9	35·3	49·3
Diarrhœa	68·6	72·3	74·3	70·3
Death-rate :				
Dysentery	1·51	3·05	1·12	1·73
Diarrhœa	0·03	0·19	0·10	0·07
Mortality per 100 cases treated.				
Dysentery	3·80	3·25	3·14	3·52

COMPARATIVE STATEMENT OF THE RATIOS OF SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS IN THE PROVINCES OF THE BENGAL PRESIDENCY DURING THE YEAR 1878.

For the year.	Ratio per 1,000 of strength.						
	Bengal Proper.	Gangetic Provinces.	Rohilcund and Meerut.	Agra and Central India.	Punjaub.	Hill-Stations.	Army of Bengal.
Admission-rate :							
Dysentery	29·0	37·9	37·9	37·5	39·1	28·9	39·7
Diarrhœa	33·7	82·5	74·2	65·2	58·3	60·4	68·6
Death-rate :							
Dysentery	1·05	1·40	0·27	1·93	2·28	0·45	1·51
Diarrhœa	..	..	..	..	0·10	..	0·08
Mortality per 100 treated:							
Dysentery	3·34	3·68	0·71	5·13	5·84	1·55	3·80

COMPARATIVE STATEMENT OF THE RATIOS OF SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN THE PROVINCES OF BOMBAY AND MADRAS DURING THE YEAR 1878.

For the year.	Ratio per 1,000 of strength.						
	Rajpootana, Malwa, Scinde, Aden.	Deccan and Nagpore.	Southern India.	Burmah and Pegu.	Army of Madras.	Army of Bombay.	Army of India.
Admission-rate :							
Dysentery	40·4	78·5	59·2	96·7	93·9	35·3	49·3
Diarrhœa	85·0	84·4	40·2	86·8	72·3	74·3	70·3
Death-rate :							
Dysentery	1·43	2·11	1·09	4·16	3·05	1·12	1·73
Diarrhœa	..	0·14	0·22	..	0·19	0·10	0·07
Mortality per 100 treated:							
Dysentery	3·54	2·69	1·84	4·30	3·25	3·14	3·52

SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN BURMAH AND PEGU DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	21	18	15	13	17	25	25	8	10	5	12	17	186	96·7	4·30
Diarrhœa ..	20	15	8	20	14	12	19	11	14	14	9	11	167	86·8	..

SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN THE PUNJAUB DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	18	10	8	37	26	18	18	17	42	89	82	46	411	39·1	5·84
Diarrhœa ..	50	44	40	82	50	48	49	55	38	66	42	50	614	58·3	0·16

SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN BENGAL PROPER DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	4	5	3	4	2	1	7	6	3	10	4	6	55	29·0	3·64
Diarrhœa ..	8	3	5	4	2	2	5	9	4	6	10	6	64	33·7	..

SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN THE DECCAN AND IN NAGPORE DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	49	37	36	31	28	35	68	81	78	46	32	37	558	78·5	2·69
Diarrhœa ..	36	42	34	39	37	25	112	103	65	52	22	33	600	84·4	0·17

SICKNESS AND MORTALITY AMONG THE EUROPEAN TROOPS SERVING IN SOUTHERN INDIA DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	29	25	13	23	19	15	39	36	27	19	12	15	272	59·2	1·84
Diarrhœa ..	21	17	27	21	12	11	21	16	13	8	4	14	185	40·2	0·54

SICKNESS AND MORTALITY AMONG EUROPEAN TROOPS IN THE HILL-STATIONS AND HILL CONVALESCENT DEPOTS OF THE MADRAS AND BOMBAY PRESIDENCIES DURING THE YEAR 1878.

Causes of admission.	Admissions into hospital in each month.												Total admitted during the year.	Admitted per 1,000 of strength.	Died out of each 100 treated.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
Dysentery ..	2	..	..	9	5	6	4	6	6	5	4	2	49	59·1	2·04
Diarrhœa ..	2	1	4	2	3	4	10	1	1	4	..	2	34	41·0	...

STATEMENT SHOWING THE RATIO IN WHICH CERTAIN DISEASES HAVE CONTRIBUTED TO MAKE UP THE ADMISSION-RATE IN CERTAIN STATIONS OF INDIA.

	Admissions per 1,000 average strength.		
	Fevers.	Dysentery.	Diarrhœa.
Stations:			
Barrackpore	1509·3	158·0	104·0
Dacca	505·6	124·5	117·0
Shillong and outposts	780·2	128·5	61·1
Dinapore..	457·4	43·6	9·9
Cawnpore (eleven months) ..	435·7	36 5	15·4
Delhi	1354 8	130·6	43·0
Mooltan	958·9	51·3	21·6
Rawal Pindi	596·4	69·5	26·9
Central India Force:			
Augur and outposts	421·1	33·8	4·5
Sehore and Indore	904·3	164·5	47·8
Dehra Ghazi Khán	920·3	71·9	33·0
Quetta (eleven months) ..	2286 4	221 6	159·1

In the hill-stations of the Bengal Presidency (1878): Average strength, 4·470 men; the average daily number of sick from—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Dysentery.	1	3	2	15	21	22	22	13	10	10	7	3	129
Diarrhœa.	3	3	4	29	43	21	43	68	35	4	4	3	260

Being 28·9 per 1,000 strength of dysentery, 60·4 per 1,000 strength of diarrhœa. Died out of each 100 cases treated, 1·55 of dysentery, 0 of diarrhœa; the total deaths having been dysentery 2, diarrhœa 0. Deaths per 1,000 of average strength, dysentery 45, diarrhœa 0.

The greatest prevalence of dysentery was in May, June, July (22); the least in January, December, February, March (3). Diarrhœa was most prevalent in April, May, July, August, September (68); least in January, February, March, November, December (3).

In the Indian civil registration the deaths from diarrhœa and dysentery are recorded under one head—"bowel complaints." In 1878 the deaths under this head averaged about 2¼ per 1,000 among 182 millions of people. But the diseases prevail to very variable extents in different districts, as may be seen from the following returns for two years:—

DEATHS PER 1,000: "BOWEL COMPLAINTS."

	1877.	1878.
Bengal	0·98	1·08
North-West Provinces and Oudh	1·98	3·87
Punjaub	1·01	1·83
Central Provinces	2·01	3.52
Berar	4·80	12·6
British Burmah	2·34	1·57
Madras	4·50	1·6
Bombay	3·72	2·54
Assam	1·50	1·50

The Berar rate is always high, and in 1878 led to inquiry. The figures show the rates intensified by famine in Madras and Bombay in 1877; next year there is a great falling-off, but the rates increased in 1878 all over the North of India, due apparently to the secondary famine arising from the sale of grain in 1877 to relieve the famine in Madras and Bombay.

To show the prevalence among the general population of a large city where it is endemic, I take the following facts from the report of the Health Officer of Calcutta for 1879 :—

The population of Calcutta in 1879 was 429,535. 1,516 persons died in the year from bowel complaints. Ratio of deaths per 1,000 of population was—fevers 11·1, cholera 2·7, bowel complaints 3·5, small-pox 1·7, injury ·52, all other causes 10·5. Fever occupies the first, and dysentery and diarrhœa the second place among death-causes.

The deaths from most prevalent diseases in 1879 show the place taken by bowel complaints in the returns :—

	1879.	Mean, 1869-72.
Cholera	1,186	1,568
Diarrhœa and dysentery	1,516	1,639
Fevers	4,796	4,656
Small-pox	772	274
Other causes	4,774	4,144
	13,044	12,281
Rates per 1,000	30·3	28·5

Fevers, small-pox, and "other causes," are above the average; cholera and bowel complaints below it.

The influence of season on dysentery and diarrhœa is shown as follows :—

	Deaths.	Combined.	
January	243	Of these—	
February	145		
March	108	Non-Asiatic	24
April	92		
May	85	Mixed races	78
June	102		
July	146	Hindoos	1,075
August	110		
September	89		
October	95	Mohammedans	328
November	139		
December	162	Others	11
	1,516		1,516

The cold months (December and January) give the largest, April and September the smallest, number of cases.

One hundred children died in Calcutta of bowel complaints; of these there were—

Non-Asiatic	1
Mixed races	28
Hindoos	52
Mohammedans	19
	100

"The mortality from diarrhœa and dysentery fell short of the average, and stands below the preceding year. These diseases do not present so marked a seasonal fluctuation as other diseases, but the returns indicate depression in the hot weather and rains, and an elevation during the cold weather."

The returns of the Medical College Hospital, Calcutta, for 1879, give the following, according to Dr. McLeod:—

Of 63 Europeans treated for dysentery, 14 died, or at the rate of 222 per 1,000 treated; of 72 natives treated, 27 died, or 375 per 1,000. Of 108 Europeans treated for diarrhœa, 8 died, or 74 per 1,000; of 44 natives treated, 10 died, or 227 per 1,000.

The death-rates in the General European Hospital were of Europeans 65 per 1,000 from dysentery, and 72 from diarrhœa.

Dr. Jones, head of the General European Hospital, Calcutta, informs me that in

	Dysentery.			Dysentery.	
	Cases.	Died.		Cases.	Died.
1865	272	32	1873	145	13
1866	281	32	1874	118	15
1867	234	10	1875	170	14
1868	243	12	1876	218	13
1869	260	17	1877	370	14
1870	173	14	1878	245	6
1871	138	6	1879	200	13
1872	188	8			

From which two facts may be ascertained. First, that since the year 1867 the mortality has greatly diminished; secondly, that the disease itself has, since 1870, also diminished in frequency. The former seems to be coincident with ipecacuanha-treatment; the latter with improved hygiene—perhaps better water! Dr. S. Coull Mackenzie has sent me the following statement regarding dysentery in the large Native Campbell Hospital. This institution is now the hospital of a great medical school, and has increased considerably in size and importance of late years:—

CAMPBELL HOSPITAL, CALCUTTA.

Years.	Total admissions into hospital, all diseases.	Dysentery.					Death-rate on total admissions.
		Total treated.	Cured.	Relieved.	Discharged otherwise.	Died.	
1870 ..	3,415	212	138	..	..	61	1·78
1871 ..	4,283	311	199	..	..	95	2·21
1872 ..	5,212	424	234	..	..	157	3·01
1873 ..	4,870	333	158	..	..	115	2·36
1874 ..	7,149	1,122	585	..	..	497	6·95
1875 ..	7,426	952	521	..	..	385	5·18
1876 ..	6,279	761	410	..	..	321	5·11
1877 ..	6,600	1,174	618	..	..	473	7·16
1878 ..	10,604	1,827	593	129	313	770	7·26
1879 ..	7,810	987	292	63	114	505	6·46

The sanitary history of Bombay illustrates the incidence of the disease on the Western side of India for 1879. The last census of Bombay in 1872 gives the mixed population of that city 644,405. It has increased since then, but as the amount has not been ascertained, it is necessary to adhere to the last census report.

There were deaths from

Fever . .	8,445 = 3·10	per 1,000.
Diarrhœa . .	1,095 = 1·70	,,
Dysentery . .	1,399 = 2·17	,,

Of children under five years there were deaths from—

Fever	3,391
Diarrhœa	415
Dysentery	336
Cholera	17

Fevers stand far before all other death-causes; bowel complaints, excluding cholera, steadily afford the second highest figure in the bills of mortality. To show how uncertain is the incidence of cholera, and how variable, as compared with fevers and bowel complaints, I cite the following from the Bombay Sanitary Report above referred to:

TOTAL DEATHS.

Years.	Diarrhœa.	Dysentery.	Fevers.	Cholera.
1874	607	1,041	5,403	19
1875	876	1,389	5,244	848
1876	815	1,164	5,867	374
1877	1,644	2,203	12,832	2,510
1878	1,258	1,829	9,944	1,183
1879	1,095	1,399	8,445	324

The fluctuations of bowel complaints and fevers bear relation to the intensifying causes—*e.g.*, the famine effects began to tell in 1876, they culminated in 1877, and began to decline in 1878-79. Although cholera was influenced, it was not so regularly affected as the other diseases by this cause. A few facts respecting the Central Provinces show that there too dysentery and diarrhœa follow a similar course, and how great a curse they continue to be to the population of India. The average annual mortality in the Central Provinces for five years from these diseases was 2·46 per 1,000. In 1878, the year of scarcity, it rose to 3·52 per 1,000, and in 1879, it had fallen to 2·66 per 1,000. Bowel complaints in India are often connected with bad and deficient food, and the Sanitary Commissioner remarks that "the returning health of the people after a season of want is shown by the great decrease of these diseases."

Prevalence in other parts of the world is shown by the following facts derived from the records of the Army and Navy Medical Department for the year 1878:—

In China, in an average strength of 1843·3 men, there were 17 cases of dysentery—1 died, 9 were invalided; 80 cases of diarrhœa—none died, 3 invalided.

In the West Indies, in an average strength of 1119·3,

there were 6 cases of dysentery—none died, 1 was invalided; 53 cases of diarrhœa—all recovered.

In West Africa, in an average strength of 542·08 men, there were 14 cases of dysentery, but no deaths; 19 cases of diarrhœa—no deaths.

In the Mauritius, in a strength of 416, there were 15 cases of dysentery, but no deaths; 19 of diarrhœa—no deaths.

In Ceylon, in an average strength of 1,015 men, there were 33 cases of dysentery—2 deaths, 3 invalided; 47 cases of diarrhœa—all recovered.

At the Cape, in an average strength of 5447·80, 173 cases of dysentery—13 deaths, 2 invalided; diarrhœa, 358 cases—2 deaths.

In Gibraltar, strength 4,702, there were 10 cases of dysentery and 60 of diarrhœa—all recovered.

In Malta, strength 6,201, there were 42 cases of dysentery—39 recovered, 3 died; of diarrhœa there were 268 cases—all recovered.

In Cyprus, strength 894, there were 28 cases of dysentery—24 recovered, 4 died; diarrhœa, 92 cases—all recovered.

In Canada, strength 1,012, there were 120 cases of diseases of the digestive system, and 1 death. The returns do not specify the nature of the cases.

In Bermuda, strength 2,017, there were no cases of dysentery. I may here remark that Bermuda occasionally suffers. My first experience of the disease, in 1843–44, was in these Islands, where there were many cases in the Naval Hospital. There were 135 cases of diarrhœa, all of which recovered.

The Naval Sanitary Report gives the prevalence of dysentery and diarrhœa in H.M.'s fleet at home and foreign stations as follows:—

Naval, 1878.

Home Station.—In a force of 65 ships of war of various sizes, and among the reserve of seamen in the Sheerness

Barracks, making a mean force of 19,000 men, 2 died of diarrhœa and 1 was invalided; the number of cases admitted not stated.

Mediterranean.—Force 36 vessels, 8,231 men. There were 14 cases of dysentery—6 invalided, 1 died at Malta; there were 636 cases of diarrhœa—no deaths, number invalided not specified.

North American and West Indian Stations.—Vessels 14, mean force 2,620 men. There were no fatal cases, 1 man was invalided for dysentery; 116 cases for diarrhœa, but none proved fatal.

South-East Coast of American Stations.—Vessels 6, and a detachment of marines at Falkland Island—mean force 590 men. No fatal cases; number of cases not specified.

Pacific Station.—Force 12 vessels, number of men, 1,740; 1 case of dysentery, 171 of diarrhœa—no deaths, none invalided.

West Coast of Africa and Cape of Good Hope Station.—Vessels 12, mean force 1,550. Cases of dysentery and diarrhœa numerous,—this was due to the Kafir campaign; a division of the Naval Brigade operating in the Transkei was specially affected. These diseases appear to be endemic in this district. Before the war they were common among the Europeans engaged in trade, but the dysentery rarely ran into the chronic form which it so frequently assumes in certain tropical localities. None of the cases were fatal; 2 invalided for dysentery, 1 for diarrhœa.

East Indian Station.—Vessels 15, mean force 2,200 men. There were 44 cases of dysentery, 198 of diarrhœa; 5 men were invalided for dysentery, 1 for diarrhœa; 2 men died of dysentery, 1 of diarrhœa. A number of severe cases of dysentery occurred in H.M.S. *London* at Zanzibar, "supposed to have been owing to chilling of the surface of the body from imprudent exposure during sleep." Errors of diet may also have contributed to produce it, and one case was certainly the result of surfeit of pineapple; finally, climatic causes doubtless played a part in the production of the malarious type of the disease. The treatment was in

every instance by large doses of ipecacuanha. The East Indian Stations include the East Coast of Africa, the Arabian Gulf, the Bay of Bengal, and islands as well as ports on the coast, Ceylon, Aden, Zanzibar, and the islands of the Indian Ocean.

China Station.—Vessels 26, mean force 2,760 men; 3 deaths from dysentery, 5 invalided; 6 invalided for diarrhœa; number of cases not specified.

Australian Station.—Vessels 4, mean force 840 men; 49 cases of diarrhœa; none of dysentery; no deaths, no invaliding.

Irregular Force.—Vessels 62, mean force 6,870, counting 9 ships newly commissioned proceeding to destination, and ships on passage home or on special service, thus representing all stations and places frequented by naval vessels. There were 20 cases of dysentery, 506 of diarrhœa—1 invalided for dysentery, none for diarrhœa; 1 death from dysentery, 1 from diarrhœa.

Of the total forces there were: Dysentery—total, 131 cases, or 2·82 per 1,000; 20 were invalided, or a ratio of ·43 per 1,000; 7 died, or a ratio of ·15 per 1,000. Diarrhœa—total, 2,508 cases, ratio 54·05 per 1,000; 11 invalided, equal to ·23 per 1,000; 4 died, equal to ·08 per 1,000.

These returns show that Europeans in India, of the class represented by the soldier and his wife, suffer considerably from dysentery and diarrhœa—men rather more than women, no doubt from the greater exposure incidental to the duties of the man; and children considerably more than adults in respect of diarrhœa, though rather less in numbers, but more in fatality, than the adults from dysentery.

The mortality from dysentery in them is nearly 14 out of every 100 cases treated, or about two and a half or three times that of women. The same may be said of diarrhœa in the class here referred to. It is to be observed that for the most part the subjects are young or in early middle life, under constant medical supervision, and enjoying the benefit of the improved hygienic supervision under which the soldier

now lives in India—a position in which he is likely to be brought under treatment at the outset of the disease. So far their condition compares favourably with that of other well-to-do Europeans in civil life in India. But one can hardly say that the soldiers' children are as favourably placed as the children of Europeans in the higher ranks of life in India; still it is evidence, as far as it goes, that the climate is inimical to the constitution of many European children, and it tends to strengthen the objections to their going to India in infancy, or to their being kept there after five or six years of age.

The native soldier also suffers considerably—82 per 1,000 of strength being affected by dysentery, 40·8 per 1,000 by diarrhœa, whilst the death-rate is 2·15 in each 100 attacked by both complaints combined, being a mortality rather below that of the European. But when we turn to the Indian gaols we find that the death-rate is 15·25 per cent., or seven times that of the soldier. The explanation is to be sought in the condition under which the prisoners live, though there can be no doubt that this has been much improved of late years; I refer to it with no purpose of criticizing the condition of Indian gaols, but to illustrate the extent to which bowel complaints are influenced by local causes. Of the general population I may remark that they suffer according to locality, mode of life, and the peculiar climate of the district.

Dysentery and diarrhœa stand next in order to fevers as a cause of mortality; and experience assures me that the scope of inquiry as to etiology must extend beyond mere local conditions.

According to Sir A. Tulloch and Dr. J. Ewart, the prevalence and mortality of dysentery are as follows in different foreign stations:—

1. West Africa.
2. Ceylon.
3. Tenasserim Provinces.
4. Madras, Bombay, and Bengal. The relative prevalence in these divisions of India I have already shown.

5. Nova Scotia and New Brunswick, with Windward and Leeward commands.

6. Malta.

From the foregoing facts it will be seen that both diseases are frequent, severe, and fatal in India among soldiers; and as the conditions of life under which these, for the most part young and vigorous men, live, are favourable, this may be regarded as a fairly good illustration of the extent to which the disease prevails.

I have said enough now, I think, to show that dysentery is almost universal, though more prevalent in certain parts of the earth than in others. That it is endemic, and often assumes a widely spreading epidemic character, in tropical latitudes, while it is comparatively infrequent and slight in others. It is not confined to the localities referred to in the official reports, but may be met with in Australia, the Americas, South Africa, Egypt, Arabia, the shores and islands of the Mediterranean, the South of Europe, and in fact anywhere, and is capable under certain conditions of becoming epidemic.

It appears to be less severe in hilly countries and above certain elevations; whilst in alluvial plains and valleys, especially where there is malaria, it is more so; and there are certain regions even in the tropics which, from some physical peculiarity of soil or of climate, seem to be exempt.

It is needless to occupy more time in describing the geographical distribution, and I shall now consider the question of causation.

First, let me define dysentery. Dysentery may be defined to be a febrile disease, the result of the action of various noxious influences, or of a specific miasm, on the body under certain predisposing conditions.

Constitutionally it presents pyrexial and nervous phenomena; locally, hyperæmia, inflammation, exudation, ulceration or sloughing of the coats of the large bowel, with certain pathological changes in the glandular follicles, in some cases extending into the ileum, accompanied by nausea,

tormina, tenesmus, scanty but frequent evacuations of gelatinous or sanguineous mucus, of sero-sanguinolent or of muco-purulent matter and blood, mingled with fæces of a peculiar odour; in the later stages, of shreds or masses of sloughs, sometimes involving large portions of the gut.

It may terminate in resolution and rapid recovery; or pass into inflammation, exudation, ulceration, sloughing, or gangrene, when it is dangerous or rapidly fatal; or it may cause a chronic condition of thickening, ulceration, and cicatricial constriction, which is tedious, and may be ultimately fatal. It may be complicated with other diseases.

Several forms are described—sthenic, asthenic or adynamic, catarrhal, fibrinous, diphtheritic, contagious, non-contagious, sporadic, endemic, epidemic, acute, chronic, malarious, cachectic, hepatic, hæmorrhagic, erysipelatous, sloughing, gangrenous or malignant, typhoid, and so on. These merely express phases or complications of the same disease-process, which always involves some part of the large gut as the seat of the essential local expression of a constitutional disease, true dysentery.

There is a tendency to involve other organs or tissues in the dysenteric process—*e.g.*, the serous membranes, kidneys, lungs, liver, spleen, etc.,—or there may be septic infection by absorption from the diseased intestine. Tropical endemic and epidemic dysentery differs from the sporadic form chiefly in degree; the morbid process is otherwise the same in both. Under certain conditions it would appear to be infective.

Etiology.

A great variety of opinions have been held as to the cause of dysentery, and many forms of it have been described. For example, Zimmerman recognized the inflammatory, the bilious or putrid, the malignant, and the chronic. Until the time of Willis and Sydenham, ulceration of the intestine was regarded as the essential element of the disease. They, with Pringle and Morgagni, aver that ulceration is not the

gravamen of the disease; that either it does not exist at all, or very slightly.

The disease, said Pringle and Sydenham, is essentially due to acrid humours in the blood. Degner considered that it was due to corrupted bile; Willis, miasmata in the blood; Stoll, in 1789, that it was due to rheumatism of the intestines. The last-named described five species—inflammatory; the summer, which he subdivided into three—the bilious, the putrid, and the malignant; the intermittent; the sporadic; and a fifth, which follows diarrhœa, of which it is only an exaggerated phase; he also added two other forms—complicated, that is, bilious and inflammatory combined; and the seventh, which, with Willis, who observed it in London in 1670, he named serous dysentery. Broussais and Pinel considered it an inflammation, more or less violent, of the large intestines—a colitis, in fact. Such may be taken as examples of some of the views formerly held as to the nature and origin of this disease.

Fouquet, who wrote on Dysentery in 1852, says that it is neither intestinal rheumatism, nor ulceration produced by bile, acrid or putrid discharges according to the older writers; nor a fever thrown on the intestines, according to Sydenham and his school; nor is it simply colitis; nor an eruption of a pustular character, produced by an acarus, according to others; but that it is a spasmodic disease of a clonic character, whose seat is in the great sympathetic, localized and manifested in the great intestine—an affection in which there is diminished general sensibility, exaltation of the contractile muscular movements of the intestine, and increase of the mucous secretion, and that when the spasms attain a certain intensity and duration, they determine organic lesions of a grave character. He says, moreover, that the indications for treatment founded on this theory are to allay spasm, to restore the normal state of the nerve-centres, and subsequently, the consideration of the intestinal lesions. As to the cause, he says that it is produced by disturbance of innervation in various ways, and, admitting that the causes usually assigned are efficient, they are so by their

action on the nerve-centres, and that the same effects may be produced by other and totally different causes. He denies entirely that dysentery is contagious, and says:—" Pour mois je n'ai jamais vu la dysentérie devenir contagieuse, quelle que fût la gravité de l'épidémie je n'ai vu ni les infirmiers, ni les sœurs, ni les médecins la contracter de cette manière. Je ne l'ai vue se répandre par contagion, ni dans les maisons particulières, même les plus sales, ni dans les hôpitaux les plus encombrés et les plus mal tenus, ni dans les vaissaux où les rapports sont continuels, où les mêmes fournitures sont communes à tous les malades. Si elle s'est répandue d'une manière contagieuse en apparence dans des villes assiégées, dans des camps ou régnait la famine, dans des circonstances exceptionelles; n'est il pas plus rationnel d'en attribuer l'origine et les ravages soit aux aliments de mauvaise nature, soit aux affections morales, soit à d'autres causes.". . . .

" Ce qu'il y a de certain, c'est qu'on ne la contracte pas pour avoir touché le corps ou les habits d'un sujet qui en est affecté.". . . .

" Ainsi non seulement la dysentérie n'est pas contagieuse; mais il n'est pas encore certain qu'elle puisse se transmettre d'une manière quelconque d'un sujet à un autre.". . . .

" Mais quand nous admettrions avec les contagionistes que les émanations des selles des dysentériques produisent la dysentérie; quand nous croirons avec Desgenettes et avec Vignes que les miasmes dégagés des substances animales en putréfaction la développent; quand nous reconnaitrons avec Zimmerman que le flair d'un sang corrumpu dans une bouteille la fait naître; ne savons nous pas que l'action des miasmes s'exerce principalement sur le système nerveux de la vie organique. Les émanations animales peuvent produire des spasmes; et si leur action est trop forte ou longtemps continuée, donner lieu au typhus, maladie ou les désordres nerveux sont en même temps si variés et si profonds, ou l'on observe tantôt un anéantissement, tantôt une exaltation partielle de cette innervation, et toujours un trouble grave dans le système nerveux cérébro-spinal et dans les nerfs ganglionnaires. La fièvre intermittente dont le foyer est

dans le système nerveux, n'est elle pas produite par un empoisonnement miasmatique? Tous les miasmes dégagés des substances en putréfactions sont des agents essentiellements perturbateurs du système nerveux, dont ils tuent la vitalité, ou dont ils sollicitent les plus violentes réactions. Les odeurs seules, lorsqu'elles sont fortes et concentrées, peuvent causer des spasmes ou les faire cesser."

And so he ascribes the origin to the operation of these causes on the nervous system. He explains the lesions that, sooner or later, occur in the bowels as a consequence of the spasmodic condition of the bowels, and not as its cause; and he dwells on certain anatomical and physiological reasons, as seen in the muscular arrangements of the sphincter, the upper part of the rectum, and in the ileo-colic valve. He says the ulcerations and diseased intestinal glands are no essential part of the disease, and points to the undoubted fact that in many severe and fatal cases no ulceration is found. These views, which are peculiar, are most worthy of consideration, though they do not altogether coincide with those of other pathologists, who regard the morbid condition of the glands and mucous membrane as essential characteristics of the disease.

Its prevalence and severity in warm countries, where malaria, climate, food and water, are instrumental in causing other diseases, seem to point to a similar origin. That there *is* something in tropical climates favourable to the development of dysentery, appears from such facts as I have related. The degree of severity and prevalence in different regions would indicate local conditions as factors in its production, whilst its occurrence in cold climates would show that the specific or exciting cause may depend on something independent of heat or malaria.

Dr. Maclean says: "It appears that many of the so-called 'causes' of dysentery must be regarded more as acute agents of propagation than of causation." "I believe dysentery to be caused by the action on the blood of a poison having a peculiar affinity for the glandular structures of the large intestine. The poison I believe to be a malaria generated

in the soil by the decomposition of organic matter"; and "just in proportion as we have banished malaria, so have we got rid of dysentery. For a long time the prisoners in Millbank were subject to visitations of dysentery at those seasons and in those states of atmosphere which most favour the decomposition of organic matter in the soil"—but, it should be added that its disappearance was coincident, also, with amended diet. The same may be said of England generally, for when malarial fevers prevailed dysentery was severe and frequent. Both have diminished in severity and frequency; and now, when seen, they are so mild as to show that the activity of the cause has been reduced to a minimum. We are still ignorant of the nature of malaria, though the researches of Tommasi, Klebs, and others are tending to show that it may be due to no miasm at all, but to an organism, a microphyte, developed in the soil, and found there, and in the lower strata of the atmosphere in certain localities and climates, which infects the blood, and being inoculated, causes a paroxysm of ague. We are ignorant, also, of the nature of the specific poison, if indeed there be one, that causes dysentery. But we know something of the active agents of propagation, and the circumstances under which it is likely to arise; and that it is apt to be prevalent and severe wherever heat, moisture, and alternations of temperature are great, and where there is organic matter decomposing in a damp alluvial soil like that of Bengal. But we cannot assert that it is altogether due to these physical conditions, for there are examples of malarial fevers and dysentery abounding in regions having quite an opposite character, and many outbreaks in camps or other collections of men under depressing conditions, but not in warm climates, such as the armies of England and France in the Crimea during the bleak and inclement winter of 1854, where, as Kinglake says, "Worn down by hard toil, numbed and lowered by cold and heat, suffering under wants so pernicious as to be too surely followed by scurvy, and assailed too by cholerine, by true cholera, by dysentery, by fevers, and by numberless other complaints, our army underwent, day by day, appalling

deductions from strength," prove that the group of symptoms called dysentery may arise under many and varying conditions. It would appear that just as sanitary progress elsewhere has diminished its endemic severity, so it is tending to do the same in India, and there can be little doubt that local outbreaks are greatly under the control of preventive sanitation. Dr. Coates, Sanitary Commissioner, in his report on Calcutta for 1877, says: "It is worthy of note how rapidly and decidedly dysentery, and indeed all chylopoietic disorders, have ceased to attack Europeans in this country. The old reckless exposure to sun and rain, the heavy tiffins, midnight suppers, and stronger liquor drinking, have ceased in proportion. Agues are getting rarer every day." And it might be added, that official reports show its tendency to decrease under the operation of sanitary laws. Still, the evening and morning damp and chills, and sudden alternations of temperature, of July, August, September, and the extreme cold night air and heavy dews of October, November, and December, acting on the poor, ill and insufficiently clad, badly fed population, who sleep on damp floors, and of whom a large proportion are broken-down in constitution, subject them in very large numbers to the influence and fatality of bowel complaints. Children and the aged are also very liable to succumb, especially to diarrhœa. Malaria, errors of diet, and bad water help materially to encourage these diseases."

Dr. F. N. Macnamara, in his "Diseases in Himalayan India," page 129, says:—"Bowel complaints, mainly dysentery and diarrhœa, stand next to fevers as causes of mortality amongst the people. The group probably includes, on the one hand, many cases which ought to be recorded as cholera, and on the other, many which would more directly have been attributed to fever complicated with diarrhœa or dysentery. Malaria, exposure, unwholesome food, such as unripe fruit and new rice, and, above all, foul water, are active causes of this group of diseases." And many other observers have recorded similar opinions.

Dr. de Renzy, Sanitary Commissioner, Assam, says:—

"On a large tea-garden in Sibsagor district, I found, on examination of the hospital books, that not only had the death-rate been reduced to less than half, but the daily sick had been reduced from ninety to forty. Similar results were obtained on a large garden in the Durrung district; the number of cases of dysentery had immediately decreased, with a corresponding saving of life, and—a very notable fact—cases of worms had become comparatively rare." This was the result of furnishing good water in lieu of that which they had been drinking. This improved water had been procured from wells deeply sunk and lined with earthenware glazed pipes, instead of the surface water contaminated with filth from the villages and other sources of impurity.

In the Native Lunatic Asylum of Calcutta, where, up to 1876, the inmates suffered much from dysentery, diarrhœa, and lumbrici, Dr. Payne discovered that "the patients were in the habit of drinking water placed in reservoirs outside the latrines for purposes of ablution. They washed and then took a mouthful of water. On putting a stop to this practice these diseases almost disappeared from the Asylum."

In regions that lie within the tropics or sub-tropical parallels, the heat and moisture, acting on organic matter, seem in some way to favour the development of the cause, and no doubt tend also to predispose the individual to become receptive of it. But none of these are sufficient of themselves to cause it, for dysentery does not invariably result when they are present, and there are regions in India, Africa, and elsewhere where it is all but unknown, albeit the conditions usually supposed to determine its prevalence exist abundantly. There are others, apparently not more unfavourable, where it is excessively severe; whilst it appears sporadically in northern climates, and has even raged as a dangerous epidemic—showing that the cause may arise anywhere under certain influences which apparently are always existent in some parts of the world, occasionally only in others. But however dysentery may arise, there seems to be no difference in its anatomico-

pathological characters, except in so far as these may be modified by malarial or other complications.

Twining, Annesley, Chevers, and others have pointed out the efficiency of impure water as a cause. I have referred to an instance of it given by Dr. Payne in Calcutta; and the diminution of dysentery and diarrhœa among the inhabitants of Calcutta, and the sailors of the shipping in that port, which is said to have taken place since the introduction of an improved water-supply replacing the tank- and unfiltered rain-water, if it be the case, confirms the probability of this view.

I am indebted to Mr. Charles Buckland, C.S., for the following information respecting the number of sailors entering or discharged from the port of Calcutta (average of three years, 1878-80):—Total Europeans, 4,040 shipped, 3,900 discharged. Total natives and other nationalities (viz., West Indian negroes, South Sea Islanders, Sandwich Islanders), 15,174 shipped, 13,552 discharged. The improvement in health in the above large floating population is, I am told, well marked since the introduction of better drinking-water. The precise number of cases of dysentery and diarrhœa I have not been able to obtain, but am informed that they have diminished considerably.

Unwholesome food, defective in quantity or quality, is an important factor, especially in the scorbutic form of the disease. Bad fermenting grain, unripe acid fruits, irritating drugs or articles of diet of any kind, excessive use of salt provisions, rancid or decomposing matters, especially fatty and albuminous articles, intemperance in alcoholic drinks, especially bad sour wines, impure spirits, and malt liquors, which irritate and cause diarrhœa that is apt to pass into dysentery in localities where the disease is epidemic.

Vicissitudes of climate, exposure to cold and heat, sudden alternations of temperature, such as occur at the setting-in of the cold season in India, or when the transition from the heat of the day to the cold of night is intense; exposure to cold damp winds, and the ill effects of the moisture of the rainy and the drying-up season in September and October,

when the air is loaded with watery vapour; exposure of the body, especially the abdomen, during sleep or when perspiring; the sudden laying aside of flannel body-clothes, and so on,—such proceedings being always pregnant with danger in a malarious or dysenteric region; even excessive dryness of the atmosphere, according to Mouat,—are effective adjuncts of the specific cause.

Pringle, at page 19 of his "Observations on Diseases of the Army," gives some remarkable instances, which it would be easy to parallel by others of more recent occurrence, such, for example, as that in H.M.S. *London*, at Zanzibar, in 1878. He says: "On June 26th, 1743, in the evening, the tents were struck, the army marched all night, and next morning fought at Dettingen. On the night following the soldiers lay on the field of battle without tents, exposed to heavy rain. Next day we moved and encamped on good ground in an open field, but it was wet (for two nights), and the first night or two the men wanted straw. By these accidents a sudden change was made in the health of the army, for the summer had begun early, and the weather had become constantly warm; now the pores were suddenly stopped, the body was chilled, and the humours tending to resolution from the preceding heats were turned upon the bowels, and produced a dysentery which continued a considerable part of the campaign. In eight days after the battle about 500 men were seized with that distemper, and in a few weeks nearly half the men were ill or had recovered." Trotter, in his "Medica Nautica" (vol. i., page 878), mentions "a lamentable dysentery" which was produced on board H.M.S. *Berwick*, in October, 1780, in consequence of the hurricane on the 5th of the month, by which the clothes and bedding of the seamen, and indeed every part of the ship, were soaked in water, and many of the men "slept for nights together on the wet decks, overcome with fatigue, and debilitated from the want of food." In seven weeks thirty of the best men died of dysentery, in some cases complicated with scurvy, and near 300 of the ship's company were ill when she arrived at Spithead. But,

remarks Bancroft, "Dr. Moseley says, 'it has often happened that hundreds of men in a camp have been seized with the dysentery almost at the same time, after one shower of rain, or from lying one night in the wet and cold' (see his treatise on Tropical Climates, third edition, page 265). I suspect, however, that in such cases the disease is not exactly like that which principally results from marsh effluvia; that it has a greater similitude to diarrhœa, and if accompanied with fever, that this is nearly related to that of catarrh." Bancroft evidently did not believe that dysentery was always produced by a specific poison, but was the result of a catarrhal condition manifesting itself in the large intestine; and it is not improbable that such is the explanation of some cases of sporadic dysentery, and that the cause, whatever it be, is the result of changes depending on external influences, such as chill and damp, thus justifying the distinction drawn by some authorities between the endemic or epidemic dysentery of tropical climates, and the sporadic cases of milder type that occur in any part of the world. That symptoms resembling dysentery do occur, even in India, is well known to those who have studied children's diseases there, when what appears to be dysentery in a child disappears on the free lancing of swollen gums during dentition and the administration of a little grey powder; whilst, in the course of other diseases, symptoms may supervene as a consequence of fever and various forms of blood-poisoning, difficult to say in what respect they differed from real dysentery. Does dysentery depend on a specific poison introduced into the system, or is it the result of a combination of several evil influences? That something is superadded in the case of malarious and tropical or other epidemic dysentery, seems probable. This must be the miasm of Maclean and others, or it may be a microphyte, like that of Klebs and Tommasi, etc.; but until we are able to demonstrate the poison of typhoid, malarial, dengue, and other fevers, this, too, must remain a matter of speculation. The fact is, we have yet much to learn, and it may be that Foquet is right, as I am inclined to believe that in a measure he is.

Impure air from any cause, but especially from putrefying organic matters, vapours from drains, cesspools, bilges of vessels, latrines and reservoirs of stagnant water putrescent with animal or vegetable matter, or it may be infected with microphyte germs, the emanations from ground that has been recently disturbed, and from which vegetation has been recently removed, from swampy, malarious, and mephitic pools whence fever, cholera, typhoid, and other evils are said to be derived, may become the predisposing if not the exciting causes of dysentery. Which particular element in these emanations dispose to dysentery, which to fever, it would be hard to say; that they do so, however, we must conclude from the evidence. And there are instances on record of dysentery of a severe and deadly type having supervened after exposure to such effluvia. I remember one, in the case of a detachment of European soldiers sent, during the last Burmese war, in 1853, to occupy an outpost near Martaban, on ground that had recently been cleared of dense tree-jungle, possibly with the view of making it healthier. That the men would contract ague or remittent was only too probable. However, there were few fever cases, whilst many suffered from dysentery, which proved rapidly fatal from gangrene affecting the whole or greater part of the large intestine. These I regard as marked examples of the worst form of malarious dysentery. Instances of persons suffering from dysentery after exposure to the foul air of latrines, bilge-water, and the like, are recorded by Fonssagrives, McGregor, D'Arcot, and other writers. But of all effluvia none are said to be more noxious than those given off from the dejecta of persons suffering from the disease itself, especially when crowded in hospitals. Whether this is due to direct infection, intensified by concentration, or to general depressing effects, causing a condition of blood-poisoning, as other putrid organic evacuations are said to do, I know not. There is reason to believe that in such cases the disease is apt to spread, and that epidemics are thus diffused. If it be true that it is infective when arising sporadically, it would appear that dysentery is capable of being originated *de nòvo*. That

such effluvia are capable of contaminating the atmosphere I have myself had proof; in hospitals, where sloughing and gangrenous cases of dysentery were treated under the same roof, if not actually in the same ward, wounds and surgical operations then assumed an unfavourable action, or septicæmia in some form, or dysentery itself, supervened.

Fergusson, who had large experience, says: "True dysentery is the offspring of heat and moisture, of moist cold in any shape after excessive heat, but nothing that a man could put into him would ever give him true dysentery." That an ordinary case of sporadic dysentery is free from danger to those who come in contact with it, I believe; but the case may be different where patients are numerous in a ward, especially if strict precautions as to removal of discharges are not observed. When certain local and climatic conditions exist, and a certain epidemic constitution prevails, the disease may from such a focus become epidemic and highly infective, though *how* I am not prepared to say. It has also been attributed to infection by fæcal contamination, just as many regard cholera and typhoid fever to be the direct result of a poison generated in the alvine secretions, or developed in the form of microphyte in the dejecta of human beings, and so conveyed to others, and thus spreading as an epidemic. Indeed, one anonymous writer, whose views are as remarkable for their force as for their originality, attributes it solely to this cause, and says: "If human excrement be not exposed to the air, there can be no dysentery." The fact is, we do not know how it originates, though we do know that under certain conditions it will appear, that it is amenable to sanitary laws, and is to a great extent preventible or mitigable. Great stress is laid by some on malaria as a cause, and the malarious dysentery is regarded by them as a specific form of the disease, whether received from air or water saturated with the malarial poison; but I do not know that there is any other difference than one of degree, or such as might naturally be expected to result in an individual depressed by malarial cachexia.

Mechanical irritation is also a recognized predisposing

cause; irregular action of the bowels, constipation, and the accumulation of scybala in the cells of the large intestine which may have been in a state of catarrhal disturbance; or where any temporary obstruction may have taken place, or when vitiated bile, or any other acrid alvine secretion is present. The form of dysentery called "hepatic" by Annesley, was connected by him with disordered liver, and bile and intestinal secretion depending thereon, setting up inflammation and dysenteric mischief in the colon.

In fact, the line between a catarrhal disturbance of the bowel and dysentery is not easily drawn.

I am not aware that individual peculiarities are of special importance. The disease may attack any one, at any age. Malariously cachectic and delicate persons, and those who are suffering from other diseases, wounds, or accidents, are liable to suffer. Men, from greater exposure and the duties peculiar to the occupations of their sex, are more liable than women, who have been thought by some to enjoy a certain immunity owing to the relief of tendency to congestion in the pelvic viscera conferred by the regular recurrence of the catamenia. Congestion of the abdominal viscera and of the portal system, especially in debilitated conditions after disease or injury, are also among the conditions favourable to the development of the disease. We are not yet in a position to define with certainty the specific or direct exciting cause of dysentery, whether it be a malarial poison, a microphyte, a gaseous emanation, a miasm, or some influence acting dynamically through the nerve-centres.

In the present state of our knowledge, we can only say that, under certain conditions and influences the disease may be expected to arise, that happily we are able, by the aid of sanitary proceedings, to moderate its prevalence, and by therapeutics to mitigate its severity. We may hope that the rapid progress now being made in the investigation of the causation of diseases will ere long throw light on that which is still obscure.

Symptomatology.

Dysentery generally commences with simple diarrhœa, probably accompanied or preceded by very little derangement of the general health. This may be of one or two days' or of longer duration. The evacuations are not at first attended with uneasiness or pain—indeed, they give temporary relief, but as the disease advances, the desire to empty the bowel becomes more urgent, and is accompanied by tormina and tenesmus, the dejecta consisting chiefly of gelatinous mucus. Little relief is now afforded by the act, which is rapidly repeated, whilst with each effort the fæculent character is diminished, until at length rosy gelatinous mucus, sero-sanguinolent fluid, or blood, is discharged. Griping is severe, and there is pain on pressure over the tumid abdomen. The dejecta have an offensive and characteristic odour. The general symptoms are more or less marked, according to circumstances and the peculiarities of the case. There is lassitude, nausea or sickness, loss of appetite, and a pinched and sallow expression of countenance; yet in some cases the disease may have advanced from the state of diarrhœa, perhaps preceded by constipation, into well-marked dysentery, before the patient recognizes the real nature of his complaint, takes alarm, or desists from his ordinary avocations. The symptoms are more pronounced in the young and previously healthy than in those who have resided long in the particular climate, or have suffered from previous disease or malarial cachexia. There may be, perhaps generally is, a certain amount of febrile disturbance, a slight rise in temperature, preceded by chilliness, sometimes a rigor, and general discomfort; but as in malarious regions fever is often present, it is difficult to say how far they may be due to this cause. As regards temperature, there is nothing that can be called typical of dysentery; the rise probably depends on periodic fever, though it *may* be due to the dysentery. The calls to stool are most frequent and severe at night;

there is a sense of fulness and burning pain in the rectum, as though some foreign body were there, which is very distressing; pain extends over the whole abdominal surface, more severe over one part of the colon than another; whilst the constant efforts to defæcate, which are so urgent that the patient will hardly leave the stool, may extend to the bladder, cause strangury, great exhaustion, and nervous depression. Such is the condition in the catarrhal or congestive stage, and it is of the greatest importance that it should be dealt with at this period, for it may now be arrested and recovery rapidly follow. Indeed, acute dysentery, in previously healthy persons, if dealt with early, before the bowel has passed beyond the stage of catarrhal congestion, is most amenable to treatment, and need cause little or no anxiety to any one. This condition may last for some days, and does not always readily yield to treatment; during its progress the patient is much worn and exhausted by suffering. Exacerbations take place during the night, which is disturbed by constant suffering. He rapidly becomes emaciated; his tongue is coated and white; the heart's action varies according to strength, and is often feeble. When the disease progresses, either in the absence of due care and treatment, or from a natural tendency to get worse, as in the epidemic form, the symptoms become intensified. The evacuations are passed with increasing tenesmus, and become more bloody, serous, or mucous, mixed with decomposing blood and fæcal matter. The tongue now becomes dry and red, in some cases affected by aphthous ulceration, or loaded with a coating of epithelium, which renders it white and swollen. Shreds of sloughy tissue begin to appear in the discharges, which are passed with intense straining. The abdomen becomes more tender, the thickened gut can be felt through its walls, the strength fails, the face becomes pinched and sunken, the skin harsh, dry, and yellow, the voice depressed, whilst the patient presents all the appearance of great exhaustion, and, sinking lower and lower, death from cardiac asthenia may result. But the changes in the gut may progress rapidly; other organs may

be involved, and the mischief spread to the peritoneum; peritonitis or perforation may occur, and cause rapid death; or in the ulcerative process vessels may give way, and copious hæmorrhage carry off the patient; gangrene may set in, when he falls rapidly into a state of collapse, indicated by cold clammy sweat, eyes sunken, voice husky, absence of pain, thready rapid pulse, body and limbs cold, dark-coloured fœtid involuntary motions, muscular spasms, and death.

It is necessary to watch the appearance of the discharges, as pointed out by Dr. Goodeve, by carefully washing them and allowing the different parts to separate. The sloughs are thus distinguished from fæces, mucus, or other matters; the state of the bowel, the stage of the disease, and the nature of the morbid process may thus be ascertained with much accuracy. Branny mucus, sloughs of various sizes, from small shreds to pieces the size of from a threepenny-piece, sixpence, to half-a-crown, or larger; sometimes tubular portions may be detected, and consist either of the exudation or of the mucous membrane itself. Though recovery is often complete, it is not always so, and structural changes in the bowel give rise to serious chronic disease, the symptoms continue, or after temporary amelioration they recur. The dejecta may become less bloody, but there is a chronic diarrhœa of loose fæculence mingled with blood, mucus, muco-purulent matter, or pure pus. The rectum is in a state of extreme irritability: there may be protrusion, or the anus is excoriated, and hæmorrhoidal excrescences form. The tenesmus and tormina are distressing, in proportion to the part of the large intestine affected; most so, when the rectum is involved. This chronic dysentery is most exhausting, and completely breaks down the health and strength of the sufferer. It is a frequent source of invaliding, and forms a considerable portion of the cases of chronic disease with which old residents in India are affected, and is very prone to pass into chronic wasting diarrhœa—of which I shall have more to say in my third lecture.

Such are the characteristic symptoms; they are modified

according to the type or form the disease assumes, or by accompanying ailments.

Various types and forms of dysentery have been described, *e.g.*, the sthenic and asthenic, under which every phase of the disease may be placed. The acute or inflammatory, attacking the young and vigorous, whether it be sporadic or epidemic, is sthenic; the sloughing, scorbutic, malarious, hepatic, and chronic, with continued diarrhœa and ulcerated or thickened bowel, are asthenic. Virchow divided it into the catarrhal or sero-purulent, and the diphtheritic or fibrinous, many cases partaking, at one or other stage of their progress, of both conditions. These he considered to have each their peculiar course and termination, but that every case is catarrhal at the outset.

In speaking of its pathology, I shall endeavour to illustrate the most characteristic pathological conditions of dysentery by clinical histories of recent cases, and by morbid specimens.

No line of separation really differentiates one type from another, but there are characters sufficiently well marked to distinguish them practically. The acute form, whether it be sporadic or epidemic, presents generally the symptoms I have described, more or less severe, according to the circumstances of the case and the peculiarities of the individual. The symptoms that characterize the malignant or gangrenous, and also the chronic forms, have been referred to.

Malarious dysentery is that in which the patient suffers from the effects of malarial poisoning, with the ordinary symptoms of remittent or intermittent superadded, with complications involving the liver and spleen, portal congestion, anæmia, gastric irritability, or functional derangement of the abdominal viscera. Under severe impressions of the malarial poisoning, as in the case referred to in Burmah, sloughing, phlegmonous or erysipelatous dysentery may set in, proving most dangerous, often fatal, death being preceded by great depression and collapse. Again, when the disease becomes epidemic among crowded

troops in the field or garrison, especially when the circumstances are depressing and unfavourable, as from defeat or overwork, bad or defective food, and where there is want of proper rest and shelter, the condition may become most deplorable, especially if to the camp-dysentery be added scurvy, scorbutic cachexia, anæmia, dyspnœa, lassitude, exudations into the areolar tissue, pain in the limbs, petechiæ, lividity following the slightest bruise, bleeding and sloughing gums, and fœtor of breath, with great general exhaustion; and, added to these, ulceration in the great intestine, attended by hæmorrhage. These make the condition an exceedingly sad one, and, though not so fatal as malignant or gangrenous colitis, cause great mortality, though, should more favourable circumstances arise—by which I mean improvement in the moral and physical condition of the men, the supply of better food, and prompt and careful treatment of all who present any indications of scorbutic taint—much alleviation is possible, and many lives may be saved. I saw such conditions among the beleaguered garrison of the Lucknow Residency. Perhaps nothing, unless it be the gangrenous form of the disease, gives a more striking illustration of destruction of the vital powers and disintegration of the living tissues.

The cause that excites the dysenteric process in the glands of the large intestine seems to act also on the liver. Dr. Budd was of opinion that liver-abscess, when complicated with dysentery, was due to infection of the portal blood by the intestinal disease, and in some instances it may be so, especially when, as in the examples I shall relate, the abscesses are multiple. Such are really typical cases of pyæmia. And I would here remark that these so-called abscesses should rather be regarded as necrosis, than as ordinary abscesses, for if they be examined in their earlier stages it will be found that they are patches of dead tissue, which, if life had been prolonged, would have been converted into abscesses by suppuration taking place around the dead tissue which, acting as a foreign body, provokes the suppuration. Liver-abscess with dysentery sometimes assumes this form,

and may be due to direct absorption from the bowel, or to systemic poisoning or embolism, as in other cases of pyæmia. This is by no means confined to the liver, for the spleen, the kidneys, or the lungs, and pleural or abdominal cavities, may be affected, and sero-puriform effusions may be found in the cavities.

The researches of Martin, Macpherson, Morehead, Moore, Parkes, Marshall, and others, show that hepatic disease is an occasional complication of dysentery in India and other malarious countries.

Dr. Parkes says that "analysis of the secretion of the liver shows that it is more or less affected in every case of dysentery, but abscess is not the most frequent complication in tropical dysentery." Baly did not find it in any of the Millbank cases, neither did Rokitansky in his experience; Dr. Wilson found it rare in the dysentery of China; Cheyne found it in the dysentery of Ireland in 1818 in four cases out of thirty; Martin says it was observed in the dysentery of the Peninsular War, but was rare in that of the Crimea. The fact is, that the liver-disease is often independent of the bowel-ulceration, though due to the same cause, and it would be impossible to predict, if a number of men were exposed to malarial tropical influences, how many would suffer from dysentery alone, from remittent fever, from abscess or other liver-disease, or how many from disease composed of all these morbid states.

Albuminuria is not a frequent accompaniment of dysentery, but it does occur, and in malarious cases probably more frequently than in others. Its import is always serious, indicating congestion, and tubes loaded with exudation; but I am inclined to think that slight albuminuria is not always of so grave a nature as may be supposed. The spleen, also, may be involved, and assume the ordinary form of enlargement, so common in malarious poisoning which is always productive of anæmia and cachexia, if dysentery supervene, it must obviously be more dangerous, where the tendency to ulceration and disintegration of tissue and hæmorrhage is so great as it is in this state.

But the spleen may be affected, also, by the cause of dysentery, and become the seat of embolism and abscess, or of softening. The lungs, directly affected by the dysenteric process or by septic absorption, may become the seat of lobular pneumonia, embolisms and local deaths, which end in abscess. The special symptoms of these conditions would, of course, be superadded to those of dysentery, and would render the prognosis more serious.

It is not always easy to distinguish hepatic complications from those of an inflamed and ulcerated transverse colon; but the general concurrence of symptoms such as rigors, sweats, the rise and fall of temperature, indicative of pyæmic abscess, and in large single abscess, which may take place insidiously and with little pain or disturbance of temperature, the physical signs of increase of size and bulging, would aid diagnosis. The danger, of course, in all such cases is great. It is to be remembered that the liver during dysentery or any other disease, or even in health, is more prone to be affected in the tropics than in cold climates, and this may partly account for cases in which dysentery and liver-abscess co-exist.

Martin and others thought that liver-abscess was intimately connected with disease of the cæcum, but this is not confirmed by post-mortem examinations, for out of seventy-two cases where the cæcum was affected, in only twenty-two was there liver-abscess.

Moore, in "Annals of Military Surgery," says that eight observers out of twelve recorded a percentage of 18, or 295 cases of liver-abscess in 1,532 cases; other four give a ratio of 39 per cent., or 52 cases of abscess out of 131 cases of dysentery. Eighteen per cent. is probably the correct ratio; the large percentage is more likely due to all diseased conditions of the liver that have accompanied dysentery.

Recent observations, I think, confirm this view of the relative frequency of hepatic abscess in connection with dysentery; and though, in some instances of multiple abscess, the condition may be due to septic absorption, yet liver-abscess generally must be regarded rather as an expression of the

general disease than as a direct consequence of dysenteric ulceration of the large intestine.

It would appear, then, that in different climates, localities, and epidemics, it is more or less frequent, according to circumstances, but that there is a greater tendency to it in India than in other climates. In malarious countries, liver-abscesses frequently occur in association with remittent fever, without any ulceration of the bowel (Morehead). Macpherson gives the comparative frequency of liver-abscess in dysentery as varying from 13 per cent. in the General Hospital, Calcutta, to that of nearly 60 per cent. (according to Annesley) as occurring in Madras. Perforation occurred in 11·7 per cent., and extension of mischief to the ileum in 13·2 per cent. (Moore).

A few words on the significance of the symptoms I have described. The tormina and tenesmus are due to irregular and excessive spasm or peristaltic action in the different regions of the colon and rectum, and especially to spasmodic contraction of the sphincter and upper circular fibres of the rectum and ileo-colic valve. They vary in extent and degree, according to the part of the gut affected. Spasm in the rectum may extend to the neck of the bladder, and cause strangury, making the desire to micturate as frequent and as painful as that of defæcation. The griping and colicky pains are less severe when the cæcum only is affected, but the more the rectum is involved, the greater the tenesmus. There are cases in which there is comparatively little pain, just as there are others without ulceration or blood.

The tormina and tenesmus are, indeed, the most distressing and exhausting features of the disease, and it is one of the main objects of treatment to allay the excessive action which causes it, and to soothe and relieve the catarrhal congestion and ulceration. The abdomen, in the earlier stages, is sometimes distended; later it rather sinks in, and when the disease has advanced, there is severe pain on pressure over the gut thickened by exudation and ulceration. In severe cases, the cessation of the pain, whether of tenesmus or pressure, is an evil sign, for it denotes failing

power, probably grangrene. The abdominal pain may be due to extension of the inflammation to the peritoneum, which is indicated by the state of the abdomen and by other concomitant symptoms of peritonitis. The mischief in some cases extends into the small intestines, stomach, and duodenum, giving rise to pain and diarrhœa like that of typhoid, whilst jaundice may be caused by the bile-ducts being catarrhally obstructed. Nausea and vomiting are frequently present. It is not difficult to understand why this should be the case, when the whole intestinal tract is sympathetically, if not directly, implicated. The evacuations are significant of the progress of the disease, and indicate the catarrhal or diphtheritic, ulcerative, and sloughing stages as they occur. The incessant tenesmus and discharges exhaust the patient, though the quantity of each evacuation is small—a few drachms only—yet in the day it amounts to a good deal. Clear, tenacious, viscid mucus, at times tinged with blood from the hyperæmic mucous membrane, indicates the catarrhal stage. As it becomes rosy-coloured, red-currant-jelly like, or stained with fæcal and bilious matters, or is sero-sanguinolent or sero-purulent in appearance, with clots of blood mingled with mucus, epithelium, bacteria, detritus of food, or foreign substances, giving the appearance of chopped meat, it shows that the disease is advancing. Or the stools may consist almost entirely of blood, depending on hæmorrhage from ruptured vessels; or of muco-purulent, or sanious fluid, sometimes pure pus, or muco-pus; certain lumps, composed of mucus and epithelial cells, which appear to have been moulded into this form in crypts, giving them the appearance of sago or frog's spawn, with the addition perhaps of some remains of articles of food. These indicate further advance of the disease. With these from time to time are mingled fæculent matter of a greyish-yellow or dark green colour, according to the changes that have taken place by decomposition or chemical reaction in their passage through the intestines. As the disease progresses, other matters are mingled with the discharges, sloughs of various sizes, from the smallest shreds to pieces of ashy or dark-looking sub-

stance of various forms and sizes, from that of sixpence to a florin, or larger, in some cases tubular. These are either portions of the mucous membrane or of exudation. The discharges (apart from the discoloration caused by drugs) become dark, grumous and fœtid, with a gangrenous odour. The exfoliation of these sloughs, which commences about the second week is, perhaps, of more frequent occurrence than supposed, and the appearances presented by them are important in estimating the actual state and progress of the case. I shall describe them in my next lecture.

In some cases the dejecta are apparently free from blood, or even mucus—they are pultaceous, of various earthy colours, and horribly fœtid, having passed over surfaces no longer yielding blood, but in a gangrenous or sloughing condition which yield their putrilage. Such cases are extremely dangerous.

The prognosis in acute dysentery, if treated early, is generally favourable. The result is rapidly successful and complete. In the advanced stages it is more tedious and uncertain, and it must be borne in mind that tenesmus and excessive action themselves may cause exhaustion and death, for it has been found on post-mortem examination that no ulceration had occurred. When the disease becomes chronic, the prognosis is more doubtful, especially when it is complicated with malaria, scurvy, hepatic or other disease, and when it occurs in conjunction with splenic or malarial cachexia. Where extensive ulceration or gangrene has occurred, the prognosis is most unfavourable, and death occurs with all the signs of collapse, consciousness and intelligence being often painfully keen and present until the end.

In my next lecture I shall describe the pathology of dysentery, and illustrate it by clinical histories of typical cases, and by morbid specimens of recent cases.

LECTURE II.

PATHOLOGY AND MORBID ANATOMY OF DYSENTERY.

Mr. President and Gentlemen,

I purpose in this lecture to describe the pathology, morbid anatomy, and treatment of dysentery, and to illustrate them by recent cases and specimens, taken chiefly from the Calcutta hospitals and from Netley.

I have already alluded to the general condition, and have anticipated in part what belongs to the pathology of ordinary dysentery.

There is nothing in the temperature that is typical, though in the acute attacks of vigorous persons, especially Europeans, there is a certain slight rise of temperature, as there would be in an acute congestive or inflammatory attack of another kind. But, as it frequently happens in India that the disease is accompanied by malarious fever, we may expect the thermometric variations that characterize that fever, whatever form it may take—quotidian, tertian, remittent, or irregular—to occur. The temperature, therefore, is not symptomatic of the dysentery, but of the fever, which results from the same general cause. In complications, where the liver, spleen, or other viscera are affected—and especially if suppuration is occurring there—the phenomena of that process will be manifested by high evening temperature, morning falls, and sweating after rigors or chills, such as occur in suppuration from other causes. I have already remarked that the true pathological explanation of multiple abscess in the liver (such as that I shall place before you) refers it to pyæmia, and that it differs from that of the

insidiously forming liver-abscess, when there is very little alteration in the temperature, which may be only a degree or two above normal. In cases of sloughing dysentery, especially when the sloughs are extensive, and in hæmorrhagic dysentery, when there has been much loss of blood, the temperature may fall below the normal standard.

In perforation, the temperature at first, during the shock, is sub-normal, but as peritonitis sets in, it again rises. This is quite apart from the dysenteric process, and the rise of temperature cannot be regarded as typical of that disease.

The seat of localization is chiefly in the large, but in scorbutic cases, and in others also, it may extend into the small intestine for several inches above the ileo-colic valve, and the whole intestine, including the jejunum, duodenum, and stomach, also may be involved in the catarrhal condition, whilst the viscera and serous membranes may suffer in the dysenteric process. The liver is especially disposed to suffer in tropical climates, and either ordinary or septicæmic abscess may occur. The spleen and pancreas may be enlarged, indurated, or softened, and become the seat of abscess. When dysentery is associated with periodic fever, the spleen is frequently enlarged; and in such cases there is apt to be splenic cachexia, and the disease is of the asthenic type. The lungs are occasionally involved, and the remarks that I have made in regard to the nature of the so-called abscesses in the liver apply to them.

The bronchial tubes may also share in the dysenteric inflammation, and their mucous membrane become the seat of puriform exudation in the finer tubes, with patches of lobular pneumonia dispersed here and there throughout the lung.

There are other complications—the erysipelatous, scorbutic, and typhoid—and one sees the close analogy of the disease with typhoid and diphtheria, and that, as the seat of the localization in typhoid is the ileum, in dysentery it is in the large intestine. Does not the tendency of the disease to pass the ileo-colic valve, perhaps, throw some light on the pathology of the so-called typhoid in India, which, by some, is referred to climatic causes, rather than to a specific fæcal

origin? If climatic conditions can cause disease in the gland-structures of the large intestine, it needs no effort of imagination to suppose a similar process may occur in those of the small intestine, or that the disease may pass the ileo-colic valve and appear in the ileum. It is not difficult, either, to imagine that the stress of the morbific agency may fall primarily on the glands of the ileum, and so give rise to the enteric lesions which so closely resemble those of the enteric fever of our own latitudes. I do not assert that it is so, but I would suggest that those who regard the disease in India as always of fæcal origin should give the subject reconsideration.

The lesions in the large intestine are the result of inflammation and exudation affecting the mucous, sub-mucous tissue, and the glandular structures of the gut and subjacent areolar tissue, which is infiltrated and swollen by effusion of serous, sero-purulent, or fibrinous matter, causing softening, ulceration, sloughing, or gangrene of the mucous membrane, which may extend to the *whole* substance of the gut. Bleker dwells on the pathological importance of the exudation, which he says takes place for the most part *into* the tissues beneath the mucous membrane, though occasionally *on* the surface in a diphtheritic form, or as in croup. But of him more presently! Virchow describes a catarrhal or sero-purulent and a fibrinous or diphtheritic form, at the same time admitting that in many cases they merge into each other, but says, "that the lesions of dysentery can only be *correctly understood* when the two forms are studied independent of each other" (Heubner).

Sporadic dysentery, he says, is chiefly catarrhal, whilst true diphtheritic or fibrinous dysentery occurs in epidemics and in the worst form of malignant and gangrenous dysentery.

In the catarrhal form, which corresponds to Rokitansky's follicular ulceration, at the outset there is hyperæmia of the mucous and sub-mucous tissues. The surface is covered by transparent mucus tinged with blood. The membrane itself is red, with dark points and patches corresponding to

folds in the mucous membrane, and when it occurs in the small intestine, to the valvulæ conniventes. The sub-mucous tissue is swollen by the distended blood-vessels, but the rest of the intestinal coats are unaffected in the outset. The mucous membrane "is swollen and of a whitish-red colour, with red areolæ round the follicles, which appear like little white knots. Where the swelling is considerable there are small apertures in the mucous membrane over the follicles. These correspond to depressions in the mucous membrane, and become filled with mucus when the membrane around swells" (Heubner).

The sub-mucous areolar tissue is swollen and infiltrated with serous or sero-purulent fluid. The whole intestinal wall may become thickened from the same cause. From this stage of acute hyperæmia, rapid recovery under favourable circumstances may take place. In the next stage, purulent softening of the mucous membrane, which assumes an irregular roughened surface, occurs. The elevations are of various shades of colour—red, yellow, greenish, black, brown—covered with viscid mucus. This appearance is partly due to the disintegration of the softened and ulcerated mucous membrane.

The sub-mucous and muscular layers are thickened and infiltrated. The follicles are destroyed, leaving depressions, or apertures, or elevations around the follicles that have not perished in the ulcerative process. They are not all so much destroyed as changed, and the apertures get filled with plugs of mucus and cell-growths, which appear in the dejecta.

The ulceration may be very extensive and fatal, but, when not so, cicatrization and repair follow.

In Virchow's fibrinous or diphtheritic form, or in gangrenous dysentery, the changes are more serious. The intestine is intensely congested, the lumen diminished, and the whole tube thickened. The contents consist of a thin reddish fluid, with some fæcal matter. The mucous membrane is reddish or whitish, and is covered with discoloured patches, and the natural appearance of mucous membrane is lost. There is infiltration of fibrous exudation throughout

the tissues, which may invade the whole gut, when gangrene and death result. Most cases, however, are probably combinations of the catarrhal and fibrinous, producing ulcer and thickening of the bowel. This causes the irregularly thickened state of the gut; and from such cases, sloughs are thrown off and ulcers form. The site and extent of these ulcerations vary. The sigmoid flexure is a common site; the cæcum in certain cases, and the rectum in others, are the principal seats of it. In some severe instances the whole gut is involved, but it may occur at different periods in different parts of the bowel. The condition of chronic dysentery into which these cases often pass, is due to these structural changes in the bowel—*i.e.*, to thickening and imperfect cicatrization of the ulcers, and to the permanently injured state of the glandular structures.

In referring to the condition of the abdominal and mesenteric glands, I alluded to the fact that they are sometimes found to be enlarged. In cases of tubercular diathesis—a condition in which dysentery, it is said, I believe, is prone to occur—the glands, and indeed the sub-mucous coat of the bowel, may be the seat of such a deposit.

The late Dr. Chuckerbutty, who divided dysentery into a great many forms, gives cases in his paper in the "Indian Annals of Medical Science" (vol. x., pp. 115, 116), in which there was such tubercular deposit in the membrane and mesenteric glands, and in the lungs, in one case; in another, he relates how the tubercular deposit was found, after death, in the large intestine itself, in the vicinity of the ulcers, under the mucous membrane, infiltrating the areolar tissue between it and the muscular coat.

Dysentery is always a subject of anxiety when it occurs during pregnancy. It is very prone to cause miscarriage or abortion, and the progress towards recovery is generally more rapid, after the ovum is extruded. It is less amenable to treatment in the early stages in this state, and in either chronic dysentery or ordinary dysentery serious symptoms are more likely to supervene in the pregnant woman than in others.

It also frequently complicates recovery after delivery, and assumes a very dangerous condition, though happily, even in this form, it is under the control of appropriate treatment.

Intestinal worms—lumbrici, *e.g.*—are a frequent accompaniment of dysentery in Bengal, and their presence must tend to intensify the local irritation and to aggravate the disease.

Bleker's description, where it differs from others, does so more in appearance than in reality; but the various accounts of the morbid anatomy by authors are rather conflicting. Dr. Aitken sums up well when he remarks: "When one says that it is a process of inflammation, exudation, softening, and ulceration of the mucous membrane, in which the solitary and tubular glands of the bowel are much, and probably primarily, involved, and in which other tissues and organs of the body and the viscera may take part, the most important conditions have been stated. The various kinds of mucus, blood, serum, pus; the extent and site of infiltration or exudation and thickening; the colour, form, and extent of the ulceration, and the magnitude of the sloughs—all express differences of degree or progress in the disease." For my own part, I think its separation into catarrhal and diphtheritic is rather artificial than real; the one passes into the other, or the two forms are so inseparably combined that, except in typical cases of the ordinary catarrhal or the severely gangrenous, most cases of dysentery present a combination of both forms.

We are indebted to the late Dr. Parkes for a description of the morbid anatomy and nature of the changes that take place in the intestinal glands and coats of the intestine. He showed that these structures are very early implicated, and that true dysentery never occurs without ulceration being present. From investigations made in Moulmein, Burmah, he concluded that, first, certain alterations in the glands of the mucous membrane of the large intestine, and sometimes of the ileum, constitute the earliest symptoms of dysentery.

Secondly, that in all cases not too far advanced the mucous membrane presented the appearance of numerous whitish

round elevations, of a size varying from a millet seed to a size so minute that only a lens can show the lesion. These elevations were hard, and, being pierced, gave forth a white excretion. Many of these had a hard black speck in the centre, and were surrounded by a vascular circle.

Thirdly, that exudation sometimes occurred in points beneath the mucous surface; that such points of exudation had a white appearance, with contents similar to those of the solitary glands. The mucous surface over these points could be easily rubbed off, leaving an ulcer (Aitken).

Baly, Cheyne, Abercrombie, and others, have observed similar changes in the dysentery of Europe, showing that the tropical so far resembles the European form of the disease.

The tubercles, pustules, ulcers, described by Pringle, Broussais, Hewson, Davies, and others, as occurring in the camp-epidemics of the Continent, have their origin in the solitary glands.

Dr. McConnell, of the Medical College Hospital, says: "The disease commences essentially and primarily in the gland-structures. I have had opportunities of seeing several cases—*i.e.*, post-mortems—at a very early period; and then the only visible alteration is in the solitary glands and follicles of Lieberkühn: the former especially, which I have found enlarged to the size of small hazel-nuts, and filled with that glazy, semi-transparent, glue-like mucus which we almost always find voided with the earliest evacuations during life in this disease."

The more severe forms, in which the mischief extends into the small intestine, are most generally seen in tropical countries; so are the inflammation, pulpy softening, changes in the mucous membrane, ulceration, sloughing, and exudation of tubular casts of a diphtheritic character. It is in such cases, too, that fibrinous exudations are apt to result in thickening chronic ulceration, and in the train of wretched symptoms that result from the contracted, strictured, and indurated gut, found in some of the worst cases of chronic dysentery.

The distinguished Professor of Pathology at Netley says:

"There can be no doubt that the anatomical signs of true dysentery are inflammation of the solitary lenticular follicles of the large intestine, tending, in the first instance, to infarction—*i.e.*, the intumescence and congestion, and subsequently to ulceration and destruction of the gland-tissue. The disease, extending by a similar process, ultimately involves the tubular glands of the general mucous membrane, which tend to soften and to be cast off as a slough, exposing the sub-mucous connective tissue, or even the muscular coat of the gut. It is the mucous membrane of the great intestine, and especially that of the rectum and lower portion of the colon, which is the seat of these characteristic lesions. The exudative process is generally diffuse, involving the whole of the tissues of the mucous membrane in a diphtheritic process of infiltration. The diseased part looks as if it were covered with a bran-like coating, especially over the summits of the folds of the mucous membrane, which are deeply reddened by ecchymosis and injection, and infiltrated by the exudation. This bran-like coating cannot be scraped off without loss of substance, and the sub-mucous connective tissue below is œdematous and swollen."

In scorbutic or other low forms of dysentery, "a diphtheritic exudation covers not only the mucous surface of the colon, but the surface of the ileum above the ileo-colic valve. This exudation corresponds with the course of the blood-vessels, ramifying from the mesenteric attachment transversely across the surface of the gut, and especially over the prominences of the transverse rugæ" (Aitken). As regards the ulcers and exudations of the bowel: the former are various in form and extent, from small circular patches to extensive ragged surfaces, corresponding to the amount of mucous membrane and sub-mucous tissue destroyed. They present different appearances and combinations, according to the extent of tissue disintegrated. The contractions of the gut that follow, where life has been saved, are sometimes exceedingly distressing, and it is to these chronic ulcerations and thickening from infiltration of the tissues of the gut that the distressing conditions of chronic dysentery are mainly due. With

these changes, the abdominal and mesenteric glands are often enlarged. The ulcers are thus described by Dr. Aitken :—

"The summary of the processes from which ulceration may proceed is as follows :—

"1. After intumescence, softening, and simple ulceration of one or several lenticular solitary glands.

"2. After intumescence, softening, and sphacelus of many solitary lenticular glands and the intervening tissue in one mass.

"3. After softening of the tubular structure and the detachment of sloughs, ulceration follows the intumescence and germination of growths from the tubes which cover the surface—as croupous, catarrhal, or diphtheritic exudation—to which the name of aphthous erosion has been applied.

"4. After sub-mucous inflammation and new growth, with fibrinous and mucinous effusion.

"5. After intertubular inflammation and inflammation surrounding the base of inflamed glands.

"6. After the formation of sub-mucous abscess.

"7. By changes of an ulcerative nature commencing in the vascular exudation itself, as in scorbutic cases."

The rectum is the part most affected, next the sigmoid flexure, then the cæcum; but in bad cases the whole gut is involved, and the appearance, when examined after death, is that of irregular ulceration, blackened or otherwise thickened. Sometimes the ulceration seems to surround the gut in rings, as it were. There are excavated ulcers—ragged, cut-out looking patches—or small circular ulcers, taking their origin in diseased solitary glands. The melanic deposit is very common and characteristic. Bleker, who wrote an interesting paper on Dysentery in Batavia in 1849, describes it as an exudation process and gives most detailed descriptions. "The deposit takes place beneath and in the mucous membrane of the colon, particularly beneath the mucous membrane, between it and the muscular coat, in the shape of solid yellowish-white fibrinous masses." This follows the hyperæmia. Next there is softening and expulsion of the exudation. The mucous membrane over it decays and

perishes. The exudation is then poured out into the cavity of the gut, and the *mucous membrane itself* is expelled. Cicatrization next takes place; and under whatever form or character the dysentery appears, the pathologico-anatomical appearances are the same, though they may differ in form and extent. He says of the forms the exudation assumes—lamellar, lenticular, tubercular, annular, diffuse, and circumscribed—it is *under* the mucous membrane, as a rule, and not on it; but he appears to have admitted, in a letter dated February 20th, 1853, to Dr. Cantor in Calcutta, that "the exudation on the mucous membrane is now and then essentially croupous, the mucous membrane becoming lined with an exudation-tube like that of the trachea in croup"; but he adds, "such cases are very rare here," *i.e.*, Batavia. He refers to sloughs of mucous membrane and sub-mucous tissue in the following terms:—"The mucous membrane itself is thrown off in the shape of larger or smaller grey-brown or blackish flakes and shreds," as a result of the pressure arising from the sub-mucous exudation; also, "The most dangerous and destructive form is the diffuse exudation. Here the mucous membrane becomes gangrenous to a greater extent. . . . . In such cases the muscular coat is often entirely obliterated, and thoroughly dissolved or infiltrated in the exudation. Both the muscular and serous coats become equally gangrenous, and there follows perforation into the abdominal or pelvic cavities."

"During life the stage is easily recognized by the flakes of exudation and pieces of the sloughed mucous membrane which occur in the evacuations."

"In lamellar exudation it sometimes happens that the mucous membrane, by itself, or with the sub-mucous membrane firmly adhering, is voided in the shape of larger or smaller flakes."

"In cases of lenticular, lamellar, and diffuse deposits, the exudation flakes, as he calls them, are small—commonly not larger than pins' heads. Some are of a consistence like gonorrhœal matter; others firmer, caseous, like half-softened tubercular substance."

With reference to the chemical composition of the dysenteric discharges, I am not aware that any observations have been made in Bengal since I left Calcutta. Dr. Aitken says justly, it is very desirable that some observations made by Œsterlen, who describes an excessive amount of albumen in them, should be verified in India. If, says he, two ounces and a half of albumen are passed by stool in twenty-four hours, it is impossible to over-estimate the importance of its occurrence.

It is very necessary to watch the characters of the sloughs thrown off during the disease. When the dejecta are washed, and the fæcal portions separated, the residue consists of ropy gelatinous mucus, branny shreddy deposits, sloughs of various sizes; and, from their condition and appearance, the progress and variety of the disease may be ascertained. The late Dr. E. Goodeve, Professor of Medicine in Calcutta, made important observations on this subject, but has not, so far as I am aware, left any written account of them. I asked my friend Dr. N. Chevers, late Professor of Medicine in Calcutta, for any information he could give me as to Dr. Goodeve's views, and also for his own, as derived from his great experience, and the following is his reply:—

"My late esteemed colleague, Dr. Edward Goodeve, is believed to have made very important observations on the dysentery of Bengal, but he does not appear to have published his views, and I am not aware that they have ever appeared in print, unless they are represented in a paper by Dr. Chuckerbutty in the 'Indian Annals of Medical Science.'

"I have strong grounds for considering that the following note embodies the leading observations of Dr. Goodeve. But whether this is or is not the case, can never now be fully proved, unless, happily, his lectures, or a manuscript on the subject, shall be found among his papers."

Dr. Chevers' Observations.

"By washing the stools throughout an attack of dysentery the following appearances may be observed:—At the onset, the first or second dejection completely, or nearly so, evacuates all fæculent matter.

"The stools then consist entirely, or with but slight traces of fæculent matter, of 'rose mucus,' of gelatinous consistence. At this stage, in most cases, the disease is readily amenable to treatment, as by ipecacuanha. This is generally the case with private patients, who, having been attacked at night, seek aid in the morning. In hospital cases the disease has almost invariably been neglected for some days previous to admission.

"In a neglected case sloughs are generally passed on the sixth or seventh day. These vary in size, up to that of a man's hand. In fair constitutions these sloughs often have much the appearance and consistence of a preserved oyster. They are oval, and nearly a sixth of an inch in thickness. They are made up of the whole depth of the mucous membrane, frequently backed with some of the muscular coat, the sub-mucous tissue being largely infiltrated with the products of inflammation. We know these as the 'pus-infiltrated sloughs.' When this kind of sloughing occurs extensively, nearly the entire mucous lining of the large intestine may come away in the form of 'tubular sloughs.'

"In this form of sloughing, it is very remarkable that, formidable as the symptoms are, the patient's condition often appears to improve, as if in proportion to the quantity of slough got rid of; but, in the end, there may be frightful puckering of the colon, and rectal stricture.

"In this form of the disease, all the sloughs having separated, we find, on washing, more or less of 'branny mucus,' which is clear evidence that the case is rather far advanced, and that it promises recovery. In a few cases we find that the vessel contains a large quantity of mucus, which is quite transparent, and so tenacious that it may be drawn out in

such a manner as to form a bridge between the brims of two utensils. We call this ropy mucus, as often happens in nasal catarrh. The presence of this mucus is, barring accidents, a sign that recovery is almost completed.

"The *gangrenous colitis* of Bengal—a disease which is usually mortal in from eight to twelve days—commences, as dysentery, with 'rose mucus,' but I have not seen either the 'branny mucus' or the sloughs described above. A few days before death we can usually discover a black or coffee-coloured sphacelated object, which almost precisely resembles an old sooty cobweb rolled together and floating in the fluid. I often sent for such a cobweb and placed it beside the slough in the plate; by outward view one could hardly be distinguished from the other. I believe that Goodeve regarded this as sub-mucous areolar tissue separated after gangrene. When these sloughs appear death is inevitable. I never knew an unfavourable prognosis fail in a single instance. With these sloughs there is more or less hæmorrhage. The stools now frequently resemble, in colour and consistence, cream mixed with blood. Once recognized, the penetrating fœtor can never be forgotten. After death, the large intestine is found lying like a dead snake; there is almost universal sphacelus of the mucous and muscular coats, and this not unfrequently extends to the peritoneal coating of the bowel.

"I have never seen inflammatory coating of the mucous membrane of the large intestine in dysentery."

I have nothing to add to this graphic account of an important part of the morbid anatomy of dysentery. In the "Indian Annals of Medical Science," vol. xii., page 117, Dr. Ewart has written a description of the same subject, and it, like all his writings, bears marks of close and original observation, and is of great value.

Dr. Chuckerbutty ("Indian Annals of Medical Science," vol. x., p. 90) describes the appearance of the dejecta and the import of each particular form of slough, and this account is believed to represent Dr. Goodeve's views. I consider that any account of dysentery in India would be incomplete

without reference to the investigations of one who made it an especial study; I therefore give them, *i.e.*, Dr. Goodeve's views, in some detail, in nearly Dr. Chuckerbutty's own words. He says:—

Molecular sloughs or putrilage show disintegration of tissue.

Flaky epithelial sloughs indicate commencing of gangrene of mucous membrane.

Thin black sloughs, plain or tubular, show the primary gangrene of the mucous coat.

Shreddy, ragged, and dark olive sloughs show gangrene in either mucous or cellular coat.

Thick pus-infiltrated sloughs show erysipelatous dysentery—very dangerous.

Grey or light yellow sloughs, plain or tubular, show phlegmonous dysentery.

Grey, shaggy, thick sloughs show violent inflammatory action.

Free gelatinous or cellular sloughs, when simple, show the presence of primary gangrene in the sub-mucous connective tissue; when pus-infiltrated, that of sub-mucous cellulitis.

Ring-shaped sloughs show ring-shaped ulceration in the mucous folds.

Discoid sloughs show circular ulcers in ecchymosed patches.

Ecchymosed sloughs show the presence of abraded minute ulcers and intestinal apoplexy.

Nodular sloughs would show the presence of nodular follicular disease; but these sloughs are very apt to be confounded with pieces of pus-infiltrated mucous sloughs of erysipelatous dysentery.

Tubercular sloughs, *if detected*, would show the presence of tubercular dysentery. This, Dr. Chuckerbutty says, he has not seen.

This seems rather an over-refinement of classification, but still it relates to what is actually seen where dysentery is frequent and severe, and it shows how much importance was attached to the study of the appearances of the sloughs, as an indication of the character and stage of the disease, by a

physician of great experience, whose opportunities of studying it were unusually extensive.

Treatment of Acute Dysentery.

It is hardly necessary to say here that spoliative or depletive measures are not to be thought of in the treatment of dysentery in these days. Whatever may have been the practice in past times as regards the use of mercury or venesection, it is no longer deemed expedient to resort to them. Even in the sthenic forms of the disease, it is, as a general rule, undesirable to abstract blood, unless such as may be taken by a few leeches applied over the course of the large intestine, and even then but very seldom; whilst the exhibition of mercury, with the object of inducing its physiological action, is altogether to be deprecated.

Time does not permit me to enter into any historical detail of the various methods of treating dysentery that have been in vogue in past times. They have been as varied as the theories of the disease itself, and the results have always been unsatisfactory, for it has been, and indeed still is, one of great fatality, hardly exceeded by any other in proportion to the number attacked. But the last quarter of a century has witnessed considerable progress in the therapeutics of dysentery, and we now know, that if it be dealt with in the very outset, there is probably none more amenable to treatment.

I shall not attempt to describe the methods of treatment that have succeeded each other since the days of Hippocrates, who, attributing the disease to acrid juices and believing that the ulceration of the intestines was merely a means for effecting their expulsion, treated dysentery with laxatives, diluents, and the like. It is needless to recapitulate to you the teaching or practice of the advocates of bleeding, mercurialism, astringents, and a farrago of drugs and nostrums that proved alike futile and unsatisfactory. I might, perhaps, with more advantage, advert to the recognition of its malarial origin, as proof that one important cause had

suggested a rational treatment to Morton, when, in the seventeenth century, he availed himself of the antiperiodic virtues of Peruvian bark as a therapeutic agent, in which he was followed by many other eminent physicians; but it would be superfluous, wasteful of time which I could ill afford, and tiresome to you to do so.

Suffice it to say that each new plan, having failed, gave place to another, and that dysentery continued to be intractable, and to frustrate the best efforts of physicians, until a medical officer of the British Army revived attention to the use of a drug that had long been known as a remedy for dysentery. Disappointed with the results of all treatment, and being convinced that bleeding, purgation, mercury, opium, astringents, and the like, all fail to give any satisfactory results, he determined to try the effect of repeated large doses of ipecacuanha alone, and being at the time in charge of his regiment in the Mauritius, where dysentery prevailed, he passed from reflection to experiment, and found the remedy so successful that, from that experiment, the results of which were published in the *Lancet* of July 31st, and August 14th, 1858, has arisen an important revolution in the treatment of this dangerous disease. It seems to me that this gentleman did an inestimable service to medicine and to humanity, but it was not until last year that he succeeded in obtaining any recognition of the important services he had rendered to the State and to mankind, when, at the urgent request of the Director-General, a gratuity of £400 was granted him! It would be interesting and perhaps not impossible, to compute the probable amount of human life preserved and money saved to the State by this officer. Let me read a memorandum on the subject furnished by competent authority, and you can judge for yourselves:—

"Mr. E. Scott Docker, while serving in Mauritius, previous to 1857, as Surgeon to the 5th Fusiliers, adopted a mode of treatment for tropical dysentery which was so successful that he published the results in the *Lancet* in 1858.

"His method, which consisted in administering large doses

of ipecacuanha, was at once taken up by army medical officers in India, with a result that is more than satisfactory. For the ten years previous to the use of this remedy, as recommended by Mr. Docker, the death-rate for dysentery among British soldiers was very large, averaging 107 per 1,000 cases—that is, nearly 11 per cent. of the cases of dysentery were fatal.

"The mortality, on its adoption, fell at once from 81 per 1,000 in 1859 to 54 in 1860, and during the ten years subsequent to its introduction the mortality-rate averaged 47 per 1,000 cases, or less than 5 per cent. proved fatal, and at the present time the death-rate is even lower.

"The recovery, moreover, is not only much more rapid than under the methods previously used, but is also more complete, and a relapse may be considered as rare. The remedy is equally effective when the native soldier is subjected to it, and the saving not only of life by its introduction has been immense, but that also of money, to the State, becomes apparent."

Dr. Joseph Ewart and others have shown how greatly the mortality has been reduced; and it is well known to medical officers who have served in countries where dysentery prevails or is endemic, that if the disease be treated early with full doses of ipecacuanha, acute dysentery is as tractable as, or more so than, ordinary diarrhœa. Hear what Dr. K. McLeod, of Calcutta, says in a recent letter, and I am sure that others could, as I can, confirm his statement:—"I have had a number of cases of acute dysentery this year, 1880, in which large doses of ipecacuanha were followed by *immediate or speedy recovery*. In one case, a man was taken ill on Saturday, had his ipecacuanha on Saturday night, and was able to attend office on Monday." "These," says Dr. McLeod, "are cases of catarrhal dysentery, I suspect. An acute case of dysentery, however severe, ought to get well under proper, *i.e.*, ipecacuanha, treatment in a week. The most troublesome and obstinate are cases of rectal dysentery with hæmorrhoids, and perhaps rectal ulcers. I have tried ergot in these cases, and found it answer better than

ipecacuanha; but rectal medication is the most successful." In the former part of Dr. McLeod's remarks I quite concur, for it accords with my own experience. About the ergot I am not so sure, for I have not had much experience of it. The ulceration and other structural changes, which are the *results*, rather than the disease itself, are less easily dealt with; but even when they are established, if there be, as unhappily there sometimes is, a recurrence of the acute symptoms, then ipecacuanha is again needed. I feel sure you will agree with me that we owe a debt of gratitude to Mr. Docker for his important contribution to the therapeutics of dysentery; and I am sure there is no assembly where this claim to recognition could be better estimated, or where it would be more freely or generously accorded, than in this Society.

Ipecacuanha had long been known as a remedy for dysentery; indeed, it was called the "*radix anti-dysenterica*," and had been used in India in small doses, combined with blue pill, gentian, and other remedies, and no doubt with good results: its revived use in late years, therefore, cannot be regarded as altogether a novelty; it is for establishing the fact of its utility in frequent large doses of the powder that we are indebted to Mr. Docker. As Mr. Justin Macarthy says of Cyrus Field, in regard to the Atlantic cable, "It was not he who first thought of doing the thing, but it was he who first made up his mind that it could be done, and showed the world how to do it, and did it in the end!"—("History of Our Own Times," vol. iii., p. 90.) Ipecacuanha was first brought to Europe in 1658 by Piso, who gave it, in doses of infusion of one drachm of the powdered root, in dysentery. Other physicians followed his example, and the practice was adopted by Friend, Pitcairn, Brockelsby, Boulduc, Balmain, Wentworth, and others since. Wentworth, indeed, gave very large doses—ninety grains combined with opium. Bateman gave it in doses of two drachms, but combined with one drachm of tr. opii, "and in many cases," says Dr. Ewart, to whose interesting paper on the subject in the "Indian Annals of Medical Science" I refer you, "I found that a dose or two was

sufficient to remove every dangerous symptom." In 1813, Mr. George Playfair, in Bengal, gave half-drachm doses, combined with half a drachm of tr. opii, and repeated the dose until the stomach became tolerant and the dysentery disappeared. English prescribed one scruple to half a drachm, with double this quantity of laudanum. In 1818, Copland gave eight to ten grains of ipecacuanha with opium, sometimes with calomel or blue pill, with the best results. Mortimer, in Madras, and after him Annesley, Twining, R. Martin, and other Indian medical officers, adopted ipecacuanha in small doses as a remedy with which they treated dysentery. But it was not until 1857—Docker's time—that it began to attain the celebrity it still maintains as a remedy to which all others are of secondary importance in treating acute dysentery.

The *rationale* of its action is explained by Dr. Ewart in nearly the following terms:—"In large doses it stops inflammatory action, augments the alvine secretions from œsophagus to rectum, increases the flow of bile and pancreatic juice, purges without irritating, lessens peristaltic action, produces rest, restrains tormina and tenesmus, promotes diaphoresis, restores the balance of the portal circulation, is a direct sedative of cardiac action; acts on the glands of the stomach and duodenum, pancreas, liver, and small intestine, and on the glands of the large intestine."

It is doubtful whether the nausea and emesis it causes are beneficial—I have always felt disposed to think that they are so—at any rate, they do not interfere with the action of the ipecacuanha.

"It produces all the benefits that have been ascribed to blood-letting, without robbing the system of one drop of blood; all the advantages of mercurial and other purgatives, without their irritating action; all the good results of antimony and other sudorifics, without their uncertainty; all the benefits ascribed to opium, without irritating, if not aggravating or masking the disease." But as Dr. Ewart also says: "Much remains to be elucidated before the true physiological action of the remedy can be fully understood."

For my part, I am disposed to believe that it is by its general effects, rather than by any direct specific action, that it proves useful.

The treatment of an attack of ordinary acute dysentery is to be conducted on the following plan :—The patient should remain in bed or in the recumbent posture ; if there be abdominal pain or tenderness on pressure, hot fomentations or turpentine stupes should be sedulously applied. A dose of twenty or thirty grains of ipecacuanha powder, according to age, strength, etc., should at once be given to an adult, in water, and the patient should endeavour to resist vomiting as long as possible,—though for my part I am inclined to think the emesis does rather good than harm. It may be well to combine ten grains of carbonate of soda with the ipecacuanha, to neutralize acidity. It is recommended by some to give a dose of fifteen or twenty drops of laudanum before the ipecacuanha, and to apply a sinapism to the epigastrium, with the view of diminishing irritability of the stomach and of preventing sickness. He must abstain from all fluids except occasional mouthfuls of iced water or bits of ice to allay thirst, which is often intense. My own plan has generally been to repeat the dose of ipecacuanha in four or six hours—a second or third time, according to the effects ; and especially if the first dose has been speedily rejected, as it often is. I have generally found that if this treatment be resorted to early in acute dysentery, it is most effective, and nothing else is needed. The pain diminishes, the tormina and tenesmus are alleviated, the restlessness is abated, the sense of fulness and desire to go to stool passes away, the skin becomes moist, and in all respects a general sense of relief is experienced. The motions become fæculent and assume a peculiar yellow appearance, significant of the action of the remedy. If any irritability should remain, a dose of ten or fifteen grains of Dover's powder is beneficial ; it gives ease, sleep, and aids in the restoration of the natural action of the bowels. Small doses of castor oil—half an ounce or less—are given occasionally, and by some are considered of importance. No doubt if there be inaction of the bowels after ipecacuanha, or

if it be necessary to aid in expelling mucus—for the irregular contraction of tenesmus is not always efficient in this respect, —the castor oil is most desirable; or if there be indications of hepatic or portal congestion, sulphate of soda or magnesia would be better.

A certain amount of nourishment should be given, but it must be fluid, and of the most bland and unirritating character—animal broths, milk and soda-water or lime-water (for milk alone will hardly be tolerated), and arrowroot. Farinaceous food, however, as a general rule, does not agree, and it is better to adhere as nearly as possible to broth and milk. In the acute stage, at the outset this alone is necessary, and all remedies of an astringent or sedative nature are unnecessary.

It is quite possible that there may be a recurrence of the acute symptoms; in which case the ipecacuanha must again be given, though it may now be in smaller doses of ten or fifteen grains—the recumbent posture and the carefully regulated diet being rigidly observed, with fomentations, and ten grains of Dover's powder at night; or an injection of starch and thirty or forty drops of laudanum.

When the disease has advanced to ulceration, and when the chronic stage has been fully established, the ipecacuanha is no longer useful.

In the case of private patients among the intelligent classes, and soldiers or others under control and observation, we are generally in a position to deal with the disease in the catarrhal stage, but not always, and some do not appear until the catarrhal stage has been overpassed, and a condition more difficult to deal with been established. In such cases where, from delay in treatment, or when the disease has been neglected, either the congestive exudative stage continues, or ulceration has begun, it may be necessary to continue the use of ipecacuanha, though in smaller doses of four or five grains, and it may be then expedient to combine it with other drugs. Dover's powder, alone or combined with quinine, and, it may be, ten or fifteen grains of soda or bismuth two or three times a day, substituted, especially at night. My old friend,

Moulvie Khan Bahadoor Tameez Khan, speaks of an extract of some euphorbiaceous plant, common in Bengal, as a remedy in dysentery, and gives some cases in which it was used with apparent advantage; but he does not speak enthusiastically of its utility, nor do I see much evidence in support of it. The powder of *Calotropis gigantea*, of the same family, has long been one of the Indian remedies, but I cannot say that I know much of its value in the treatment of dysentery.

Complete rest, not only of the body, but of the intestines, is necessary, and for this reason the recumbent posture, and remedies that allay muscular spasm, are necessary.

Judiciously used, opium may be of great benefit, but, as a general rule, it is better to avoid the use of it, as much as possible, for it inhibits that which it is our object to produce —free secretion.

Dysentery in the acute form having passed away, may merge into diarrhœa; which, to some extent, may be due to the ipecacuanha. This, if it do not rapidly subside, may be controlled by any simple astringent, such as chalk mixture, catechu, kino, hæmatoxylin, the red eucalyptus, with bael; but it is *only* in this condition that astringents are of advantage; in the early and acute stages they are out of the question. Most cases of dysentery, in Bengal at least, are more or less associated with malaria, and therefore quinine is a desirable adjuvant to other drugs; and in cases where the malarial indications are well marked it may be expedient to give it in large doses. Mr. Hare, the Surgeon of the 1st Bengal Fusiliers, advocated its use most warmly, not only by mouth, but as an injection, and his results certainly appeared to confirm the justness of his views. Less importance is attached to them now, but still the value of quinine in malarious dysentery is fully recognized, and it should be, and is, given alternately with the ipecacuanha until the physiological action of both has been manifested. Again, in the splenic form, sulphate of iron may be combined with advantage; but it is to be remembered that neither quinine nor iron are likely

to be of any service if they are given when the portal system is congested, or when the intestine is in the state of engorgement of the catarrhal process. A great difficulty in cases of debility often naturally arises about giving the ipecacuanha, but it is better tolerated than might be supposed, even in the weak and anæmic; and its use may be preceded by some cordial, whilst support may be given afterwards by the same means, for, though otherwise depressing, ipecacuanha certainly removes the *fons et origo mali*, and so with a little evil does great good.

Where the dysentery is of the scorbutic form, it is necessary to improve the condition of the blood by the use of better food —vegetables and fruit. Astringents also, with mineral acids, may be expedient, even in what corresponds to the acute stage. At the same time, Dover's powder, or even ipecacuanha alone, may be useful. Under this treatment, the dysenteric symptoms abate, with the general improvement in health. In such conditions the bael or the koorchee* are certainly useful with the Dover's powder. But whenever the urgency indicates any great access of inflammatory mischief or congestion of a catarrhal nature in the mucous membrane or around the ulcers, the ipecacuanha must be again resorted to. When the catarrhal or congestive follicular stage has passed into the ulcerative stage—that, indeed, which is the condition in the greater part of the cases that have been neglected at the outset, or have not yielded at once to treatment—the question is, What is to be done for these ulcers, this thickened state of the bowel, etc., before the disease has passed quite into the chronic state?

The object is to give rest, to support the strength, to avoid all irritation and recurrence of inflammatory action. Turpentine in small doses, twenty drops three times a day, with a certain amount of opium, and local medication, with argent. nit. injections, and, where the rectum is implicated, with ergot injections and opiate enemata to allay tenesmus and pain. Large enemata of tepid water are also useful. It will take time for the ulcers to heal, but it is remarkable

* Bael, or Ægle marmelos; Koorchee, or Wrightii anti-dysenterica.

how rapidly they seem to do so under favourable circumstances and careful attention to diet and treatment. Any recurrence of acute dysenteric symptoms indicates the need for ipecacuanha.

In advanced cases, where ulceration and sloughing have commenced, the use of ipecacuanha is contra-indicated, whilst opium or Dover's powder, to the extent of allaying pain or irritation, will be necessary, but care must be taken to avoid opium intoxication. It has been recommended by Waring to combine it in small doses with small doses of nitrate of silver; but I cannot say that in my own experience I have seen any special benefit derived from this remedy, though in some chronic cases it may have proved useful. In hæmorrhagic dysentery, where the loss of blood is great, ergot as an enema, twelve or fifteen grains in starch or arrowroot, has been found efficacious. If the hæmorrhage be profuse it may be desirable to use tannin in the same way; but otherwise, astringents are contra-indicated in acute dysentery.

Preparations of iron with calumba are often useful during recovery, and the greatest care must be taken to avoid any error in diet, which for some time must be of the simplest kind.

Rest and diet are most important elements in the treatment in the early stages. The food must be of the blandest and most simple character, and all solids should be avoided. This is equally necessary in the sloughing and ulcerative or gangrenous stages; but here it is essentially necessary to support the strength, and animal broths are desirable, with a certain amount of wine or other alcoholic stimulant as may seem most expedient and suitable to the habits of the patient. In cases where the inflammatory action is sthenic, and where the pain is great, the use of a few leeches over the swollen and tender bowel may be useful; but I believe such cases to be quite exceptional. Opiate enemata at night, to give rest and relieve the tormina and tenesmus, will often be beneficial; but again I would say that it is necessary to beware of inducing narcotism.

In malarial cases I have already said that quinine is necessary. It should be given until the patient is cinchonized, whilst paroxysms of fever should be anticipated by the exhibition of full doses of ten grains; some give twenty.

In cases of dysenteric liver-abscess, if the abscess point or become sufficiently apparent to justify the operation, it should be freely opened antiseptically, and the pus drawn off through a drainage-tube; but the probability of the abscess being multiple should be borne in mind, and that if it be so there is not much hope of permanent benefit. Still, it is possible that it may be single, and no prospect of affording relief should be neglected. There are cases in which, though the success may be only partial, yet, if it afford any prospect of relief, the operation should be performed, antiseptic precautions being observed; and there is every reason to believe that the operation is attended with so little risk that even as a measure of temporary relief, even though it cannot save life, it is expedient.

I shall now request your attention to the clinical records and morbid anatomy of some recent cases and specimens, for which I am indebted to friends in Calcutta and at Netley.

Time will not permit me to relate all that I have here, so I must select a few cases in which the symptoms, treatment, and pathology are typically represented.

Case 1.—Catarrhal Dysentery.

Second Physician's Ward, Medical College Hospital, Calcutta; Dr. Chundra.

W., a Mahomedan male, aged thirty-eight, a labourer, was admitted into the Medical College Hospital, for an attack of dysentery, on March 2nd, 1880.

History.—Had been suffering from looseness with griping for a fortnight. The stools, about twelve in twenty-four hours, contained blood and mucus.

Is healthy-looking. Tongue moist and clean. There is pain on pressure over iliac fossa. Stools contain no fæculent matter, but a large quantity of jelly-like mucus, deeply tinged with blood. Pulse small, soft and weak. No splenic enlargement.

A dose of castor oil with tinct. opii was given, and a powder containing bismuth, ipecac., and sodæ bicarb., five grains each, three times a day, ordered; milk and sago diet.

March 3rd.—Morning: Four stools, consisting of mucus, blood, and small pieces of slough. Evening: Three stools; green fæculent matter, with less mucus and blood.

4th.—Stools fæculent, with traces of mucus and blood.

6th.—Four loose, bilious, and fæculent stools; no mucus or blood. Powder omitted, and bael and koorchee mixture ordered, three times a day.

He rapidly recovered, and was discharged on March 19th.

Simple catarrhal dysentery, well in seventeen days.

Case 2.—Catarrhal Dysentery.

T. S., a European seaman, aged twenty-one, admitted on November 30th, 1878, into Medical College Hospital, Calcutta; discharged December 5th, 1878.

History.—Had been suffering from dysentery for ten days. Stools scanty and very frequent; contain only blood and mucus. Healthy-looking; tongue moist and coated; pulse full, soft, and regular. Passed about six stools within half an hour. They contain fæculent matter with shreds of mucus and blood. No pain in the abdomen.

On admission a large water enema was ordered; bismuth, ipecac., and soda, five grains each, three times a day.

December 1st.—Had one stool after the enema, and five stools since last night. They contain a large quantity of shreddy mucus and blood.

2nd.—Stools unchanged in character. Vomits the powder. Ordered a draught containing tinct. opii and spt. chloroform, to be taken half an hour before each powder.

3rd.—Retained the powder. Had four stools containing bilious fæculent matter and traces of mucus and blood.

4th.—Had no stools last night.

5th.—One formed stool. Discharged.

Well in five days. Duration of the disease about fifteen days.

Case 3.—Catarrhal Dysentery.

S. K., a Mahomedan, aged twenty-five, was admitted on March 6th, 1880, Medical College Hospital, and discharged on the 15th.

Had been suffering from dysentery for a fortnight. Passes about twelve stools in the twenty-four hours, containing blood and mucus.

Condition on Admission.—Is healthy-looking; tongue moist and clean; pulse small, soft, weak; no pain on pressure over the abdomen; stools contain shreddy mucus and blood. Bismuth, ipecac., and soda, āā gr. v., three times a day.

March 7th.—Stools are greenish, fæculent, with a small trace of mucus and blood.

By March 9th, the stools were free from any mucus and blood.

The powder was omitted, and bael and koorchee mixture ordered, three times a day. The stools gradually became formed, and he was discharged on March 15th, 1880.

Well in nine days; duration of disease about twenty-three days.

Case 4.—Acute Catarrhal Dysentery.

K. D., Hindoo, a badly nourished boy, aged sixteen, was admitted into the Mayo Native Hospital, under the care of Dr. Cayley, on September 23rd, 1880.

Has been ill with looseness and fever for four days. Complains also of cough. On auscultation, fine moist râles are audible at the base of the left lung; skin harsh, dry, and hot; pulse feeble. ℞. Spt. chloroform. ♏ xv., mist. cretæ ℥j. Diet, sago and milk.

September 23rd.—5 p.m.: Temperature 100° Fahr. Five stools since admission; complains of griping.

24th.—Has had six stools in the night; they contain slime and a good deal of greenish-yellow liquid fæculent matter. Tormina and tenesmus excruciating. Temperature 98·2° Fahr. Ordered—℞. Tinct. opii ♏x., aquæ menth. pip. ℥j., stat.; followed by—℞. Pulv. ipecac. gr. xv. Diet, sago and milk. 5 p.m.: Temperature 98·4° Fahr. Vomited once; passed four motions, containing mucus and blood, in the day. Griping and straining greatly diminished. ℞. Ipecac. gr. iss.; ext. bellad. gr. ¼; pil. j. ter die.

25th.—Temperature 98·4° Fahr. Four stools in the night. The stools are composed of fæculent matter, with gelatinoid exudation only. Griping and straining much less than before. Pills continued. Diet, sago and milk. 5 p.m.: Temperature 98·4° Fahr. Six motions, consisting of soft yellow fæculence with a little slime. Vomited once.

26th.—No stool; no fever; no griping and straining. Continued pills twice daily. 5 p.m.: Temperature 98·2° Fahr. One fæculent stool, containing very little slime.

27th.—No stool; no fever. Pills continued twice daily. Diet, rice, fish, milk.

28th.—One healthy, well-formed stool. Pills omitted. ℞. Acid. sulph. dil. ♏viij., inf. calumbæ ℥j., ter die.

29th.—Doing well.

Discharged on October 1, 1880, in seven days.

Case 5.—Acute Dysentery.

Medical College Hospital, Calcutta; Dr. McConnell.

William S., a Norwegian seaman, aged about forty, was admitted on July 10th, 1878, into Medical College Hospital, having suffered from dysentery for four days—*i.e.*, seven to eight stools in twenty-four hours, passed with much griping pain, and composed of blood and slime.

He is well-built and muscular, but has a worn and anxious expression. The tongue is moist, but much coated.

The abdomen is retracted; great pain on pressure over the right iliac fossa and along the course of the large intestine. No hepatic or splenic enlargement. Heart and lungs normal. The stools are very frequent, and consist principally of blood and rosy mucus; they are passed with much griping and straining.

From the 10th to the 14th his condition remained almost the same, the number of the stools decreasing; somewhat less blood was passed, but rosy mucus still in abundance, and pain all over the abdomen severe.

July 15th.—The character of the evacuations changed; they were now watery and highly bilious, without a trace of either blood or mucus, but having a very offensive "fishy" odour. The patient very weak and prostrated; voice low and husky. This prostration gradually increased. On the morning of the 17th he was found quite collapsed; the skin cold, covered with clammy perspiration, and over the hands and side of the thorax exhibiting numerous sudamina. Pulse imperceptible at the wrist. He sank the same evening.

TEMPERATURES.

1880.	Morning.	Evening.	1880	Morning.	Evening.
July 10 ..	—	100·0°	July 14 ..	99·0°	98·2°
,, 11 ..	98·4°	100·0°	,, 15 ..	98·6°	98·0°
,, 12 ..	98 4°	99·0°	,, 16 ..	98·4°	98·0°
,, 13 ..	98·0°	98·2°	,, 17 ..	97·2°	—

Treatment.—Cinchona alkaloid, pulv. ipecac., āā gr. v., ext. hyoscyami gr. v.—two pills; tr. opii ♏xxv., aq. camph. ℥j.; followed by gr. xx. pulv. ipecac. in bolus; also opium suppositories, and latterly small enemata composed of pulv. ipecac., liq. opii sedativ., and mucilage.

Post-mortem Examination (July 18th, 1878; about seventeen hours after death).—Body moderately well nourished. The skin of the back, shoulders, and chest covered with sudamina and larger blebs, containing either serous or sanguineo-serous fluid, the latter of dark purplish colour. An old cicatrix on the glans penis. Head: Brain a little softened and anæmic

(Pineal gland twice its normal size, and partially cystic); structure otherwise healthy. Thorax: Heart flabby and uncontracted. Right cavity contained fluid, dark blood, and small, dark, soft coagula. Similar but smaller clots in the left cavities. Aortic valves thickened; the central flap has a calcareous nodule. The ascending aorta shows patches of syphilitic endo-arteritis. Lungs: Anterior portion pale and emphysematous. Posteriorly and at the bases very dark, soft, and deeply congested. Abdomen: Liver large, weight 3 lbs. 10 ozs.), of dark red colour. The large portal and hepatic veins filled with fluid blood (frothy from incipient decomposition); liver-substance generally soft; lobular structure indistinct. No reaction with iodine. Gall-bladder collapsed; duct free; bile thin, of turmeric-yellow colour, and measures only about a drachm. Spleen a little enlarged, soft and dark, weight 7¼ ozs. Kidneys somewhat darkly congested, like the other abdominal organs. The left, partially cystic at upper end. Nothing else remarkable. Alimentary canal: Stomach small and contracted, dark purplish in colour, and highly congested at the œsophageal end. The mucous membrane of the small intestine is bile-stained, in the duodenum and jejunum. In the ileum, the patches of Peyer are a little prominent, and present the "shaved beard" appearance. The whole of the large intestine presents a thickened, swollen condition, the mucous membrane being in a state of sphacelus or acute slough. The sloughs are arranged more or less tranversely along the folds of the intestine; they are of a greyish colour, highly putrid, the majority still adherent to the adjacent tissues, some very loosely so, and others again, particularly in the rectum, have entirely separated, exposing raw red ulcers. The sub-mucous tissues, and even the muscular coat in parts, are pus-infiltrated and very vascular. The mesenteric glands are a little enlarged and hyperæmic. The stomach contains about four ounces of thin highly bilious fluid; the small intestine about the same quantity of yellowish muco-fæculent fluid. The large gut is empty.

Case 6.—Acute Dysentery.

G. D., an East Indian, aged forty-two, a compositor, was admitted on August 14th, 1880, into the Medical College Hospital, and died on August 28th. (Dr. McConnell.)

History.—Has been suffering from irregular attacks of intermittent fever for the last three months. During the last three days the stools have become very loose and frequent. Is an opium eater, and is poorly nourished. The skin harsh and rough. Pupils a little contracted. Complains of pain all over the abdomen, which increases much when he goes to stool, and shoots down to the calves of his legs. The tongue is moist, but coated. No appetite. Heart's action regular; pulse small. No enlargement of liver or spleen. The stools are seven or eight in the twenty-four hours; they consist of blood and gelatinous mucus, and are passed with much griping and straining. The temperature rises slightly in the evening (see chart below).

The evacuations continued much the same, except that the blood lessened, and small sloughs came away, between August 18th and 20th. On the latter date improvement was noticed. Stools every four in the twenty-four hours, partly fæculent, and containing only a little blood.

The relief, however, was only temporary. On the 26th the motions increased in number (fourteen during the preceding twenty-four hours), and contained shreddy mucus with pus and blood. Troublesome hiccough now set in, and the patient became very low, his countenance anxious, and features sunken; the tongue dry and hard.

On the 27th the stools were passed in his bed-clothes very frequently, and almost unconsciously. Hiccough still continued. Voice husky. Semi-delirious.

Gradually sank and died on the 28th.

TEMPERATURES.

1880.	Morning.	Evening.	1880.	Morning.	Evening.
Aug. 14 ..	—	98·4°	Aug. 21 ..	98·6°	99·9°
,, 15 ..	98·4°	99·0°	,, 22 ..	—	—
,, 16 ..	98·4°	100·0°	,, 23 ..	98·2°	102·6°
,, 17 ..	98·6°	100·0°	,, 24 ..	100·8°	102·2°
,, 18 ..	98·6°	99·8°	,, 25 ..	101·6°	101·6°
,, 19 ..	98·6°	98·4°	,, 26 ..	100·2°	102·0°
,, 20 ..	98·0°	100·0°	,, 27 ..	101·4°	98·8°

Treatment.—Turpentine fomentations with large poultices to abdomen. Tinct. opii ♏xv., spt. chlorof. ♏xxv., aquæ menth. pip. ℥j. Sedative draught to be taken three times a day, ten minutes before the following powder, viz.:—Pulv. ipecac. gr. x., sodæ bicarb., bismuthi nitrat., āā gr. v. Anodyne enema twice daily. Anti-spasmodics (musk, ether, etc.) for the hiccough. Changed on the 22nd to tinct. opii ♏x., spt. sulph. aromat. ♏xv., ext. belæ liquid. ʒij., decoct. koorchee ℥j. (*Wrightii anti-dysenterica*), four times a day. On the 24th, plumbi acetas gr. v., ext. opii gr. iss. in pil., four times a day. On the 26th, tinct. catechu ʒss., tinct. kino ʒss., tinct. opii ♏x., decoct. hæmatoxyli ℥j., four times a day. Lastly, hospital stimulant mixture, one ounce every two hours.

Post-mortem Examination (August 28th, 1880; eight hours after death).—Body emaciated; rigor mortis strong in the lower extremities; none in the upper. Pupils dilated. Brain: Substance soft and anæmic; otherwise normal. Thorax: Lungs congested; their bases dark, heavy, and softened. Liver: Substance of dark muddy or slate colour; is firm. Bile-ducts contracted; gall-bladder full; bile thick, from the presence of much ropy mucus; measures an ounce and a half. Weight of liver 2 lbs. 7 ozs. Spleen a little enlarged; capsule slightly thickened; substance soft and dark; weight 9 ozs. Kidneys moderately contracted and distinctly "granular"; weight—right 3½ ozs., left 4 ozs. Stomach of normal size; mucous membrane pale and anæmic; as also is that of the small intestine. That of the large gut is throughout thick and œdematous. From cæcum to anus, covered with small

superficial ulcers, of irregular outline, with much recent congestion and vascularity of the surrounding bowel, and the presence of a little recent exudation (lymph) over the surfaces and up the margins of these ulcers. The sub-mucous tissue in parts undermined and pus-infiltrated, everywhere much thickened, as also is the muscular coat. The post-peritoneal cellular tissue in connexion with the ascending and descending colon is also thickened, and the lymph-glands are enlarged. The mesenteric glands are a little swollen and œdematous. The stomach contains about half an ounce of curdled milk; the small intestine, about two ounces of soft bilious muco-fæculent material; the large gut about an ounce of thin reddish serous fluid, with shreddy mucus and minute blood-coagula.

Case 7.—Malarial Dysentery.

M., a Hindoo boy, aged seven, native of Hoogly, admitted into the Mayo Hospital, under Dr. Cayley, on September 16th, 1880. He had been suffering from dysentery and prolapsus ani for four months. The child complained of much griping, and there was some fever; he was much emaciated, and had enlarged spleen. In the evening the temperature rose to 102·8°. He had seven stools in the day, composed mainly of blood and a little slime. Spt. chlorof. ♏v., with chalk mixture ℥ss., was given after admission, and a powder containing ferri carb. gr. iij., with pulv. cinchona gr. ij., and pulv. cretæ aromatic. gr. v., thrice a day; and sago and milk diet.

September 17th.—Had had nine stools, passing much undigested milk and slime. Ordered a powder composed of ipecac. gr. j., Dover's powder gr. j., soda gr. iij., thrice; and liquor calcis was given with the milk. Temperature 98·4°, but in the evening it rose to 102°.

18th.—Twelve stools in the night, composed of blood and slime, and the temperature ranged from 99·2° to 101°. Two grains of quinine were added to each dose of the powder, and the same diet was continued.

19th.—There were only three stools, with little slime and

no blood. Temperature 99·6° in the evening. There was no fever.

20th.—There was slight fever; temperature 99·2°. Seven stools in the day, with slime and blood, and four stools in the night, containing undigested milk and slime. A powder composed of ipecac. gr. j., comp. kino gr. iij., and bismuth gr. j., given thrice.

21st.—Three stools in the day, and seven in the night, with much undigested food and slime. The temperature ranged from 98·4° to 102·4° in the evening. The medicines were continued, and fomentation over the belly was ordered.

22nd.—Six stools, with less slime than before, but more offensive, with sloughy-looking shreds of membrane; tormina and tenesmus. In the night ten stools of similar character. Cold compress was applied over the belly, and ice was given constantly to suck. Temperature ranging from 98·4° to 103°.

23rd.—Temperature 99·6° to 102·6°. Six stools in the day, with slime, but no blood; and seven in the night. A mixture of iron alum, sulphuric acid, and opium was given four times, and arrowroot, milk, and ice for diet.

24th.—Temperature 98·8° to 99·8°. Seven stools last night, and eight during the day; again much blood and slime, attended with pain and straining and prolapse of the rectum.

25th.—No fever in the morning; temperature 102·6° in the evening. Two stools only in the day, and twelve in the night, still composed of slime and blood. Dover's powder gr. iij., with comp. kino gr. ij., and ipecac. gr. j., given four times; and an ounce of rum added to the former diet.

26th.—The stools passed were very offensive, watery, and of dirty brown colour. Evening temperature 102°. An injection, composed of alum gr. xv., tincture of opium ♏x., and aquæ ℥vj., was given twice per rectum.

27th.—Three stools, with slime and blood. The temperature ranged from 99° to 100°.

28th.—Two stools in bed-clothes, watery and offensive; and three stools in the previous night. Temperature 97·6° to 101° Fahr. Patient becoming very low.

29th.—The temperature ranged from 98° to 101·8°. Constant stools passed in bed-clothes. Unable to swallow. Pulse imperceptible. Died at 10·30 in the night.

This was an acute attack coming on in the course of old chronic dysentery in a child with enlarged spleen, and constitution broken down by malaria.

No post-mortem.

Case 8.—Malarial Dysentery.

Mayo Native Hospital, Calcutta; Dr. Cayley.

H., a Hindoo lad, aged eighteen, was admitted into the Hospital on August 12th, with symptoms of acute dysentery. For ten days he had been suffering from remittent fever, and from the day previous to his admission had had frequent scanty evacuations of mucus and blood, with griping and straining at stool.

On admission, the boy was found to be emaciated, with fulness of the belly, and an anxious expression of face, which was bedewed with perspiration. There was fever. The spleen was enlarged, as also the left lobe of the liver. There was much tenderness of the abdomen, especially in the epigastrium and over the spleen. In the evening his temperature was found to be 103° Fahr. He had two scanty motions after admission, composed solely of mucus and blood, with no fæcal matter. A ten-grain dose of Dover's powder was given at bedtime. During the night he had much griping with frequent stools, composed chiefly of blood.

August 13th.—Temperature 99° Fahr. Ordered half a grain of opium, followed by twenty grains of ipecacuanha. In the day the stools continued the same, but were more frequent and the tormina and tenesmus aggravated; he vomited three round worms. In the evening there was no fever, when a dose of santonin gr. iij., with soda gr. v., was given at bedtime. He passed a restless night, with incessant calls to stool.

14th.—A pill of ipecac. gr. ij. and ext. belladonna gr. $\frac{1}{3}$ was given twice. No more worms were passed, and there was no fever. The temperature was 98·4°. The stools continued scanty and slimy, the tormina and tenesmus very severe. Evening: No fever. A dose of Dover's powder besides the pills was given.

15th.—About the same; but the griping pain rather less severe. Instead of pills the following mixture was given:—Ferri sulph. gr. ij., alum. sulph. gr. v., acid sulph. dil. ♏x., and peppermint-water ℥j., three times a day, and fomentation for the abdomen.

16th.—Griping increased; stools remaining same; no fever. The mixture omitted, and pills of ipecacuanha and belladonna again given. Evening temperature 101°. Issofgool ℥ss. was given at bedtime.

17th.—The stools became less frequent and of reddish-brown colour, consisting of blood and mucus and small coagula. Temperature 98·6°. The same medicine continued, and cold compress over the belly was ordered. The patient was hitherto living upon sago and milk. In the evening there was slight fever; temperature 100°. Ten minims of chlorodyne given at bedtime.

18th.—The stools were better; with the slime and blood there was fæcal matter; tenesmus less severe; tenderness over belly less. Temperature 98·2°. Instead of pills, issofgool ʒj. (*Plantago Isphagoola*) twice a day ordered, and cold compress continued. In the evening temperature 100°. Rice and milk given for diet.

19th.—Temperature 98·2°. The stools were copious, but less frequent, consisting of slime, with vitiated bile and fæcal matter, with streaks of blood. In the evening the temperature rose up to 101° Fahr. There were five stools throughout the day.

20th.—The patient was much in the same condition, the temperature ranging from 98·4° to 101° in the evening.

Ipecac. gr. ij., opium gr. j., given thrice in the day, and continued for the next day. A little rice and fish were given, but he was again troubled with many stools in the night, com-

posed mainly of slime and undigested food, but no blood. The temperature ranged from 98·4° to 100·4°. His diet was again changed to milk and bread, and the same medicine continued.

22nd.—Another scruple dose of ipecacuanha was given, after which he had eight stools, composed of slime, biliary and fæcal matter, with little blood; griping less than before. Temperature 98·2° to 102·4°.

23rd.—The patient still passed slime with little blood, but the tormina much abated. The temperature ranged from 98·2° to 101·2°. Ipecacuanha and belladonna pills were given thrice, and rice and milk for diet.

24th.—The stools became fæculent, with a little mucus. The patient now gradually improved, and his bowels became natural. The pills were changed to small doses of iron-alum, and sulphuric acid with tincture of opium, and a mustard-plaster was applied over the spleen, to allay pain. He was now given rice and milk diet, with addition of a little fish and rum.

26th.—Liniment. iodin was painted over the spleen.

September 13th.—After full diet, got an attack of diarrhœa, which was checked after two days by chalk mixture with chlorodyne. He was then given nitro-muriatic acid with bark, and half rice and fish diet.

17th.—There was a return of fever, with a temperature of 101° Fahr., and the following day five grains of quinine were given and half an ounce of spleen mixture, composed of quinine gr. ij., acid. sulph. dil. ♏x., ferri. sulph. gr. ij., tinct. zingiberis ♏xx., aquæ ℥j., given three times a day, and iodine liniment painted over the spleen and liver.

18th.—No fever. Evening temperature 99·6° Fahr.

After this there was no rise of temperature, nor any recurrence of diarrhœa or dysentery. The patient was discharged cured on September 22nd.

Case 9.—Malarial Dysentery.

P., a Mahomedan male, aged nineteen, admitted into the Mayo Native Hospital on July 21st, 1880. He has been

suffering from fever, of continued type, for the last seven days. Complains of cough and pains all over his body. Bowels loose. On auscultation, breathing was found to be harsh and tubular in the back of chest. Temperature 98·4° Fahr. Ordered tinct. opii ♏v., spt. chloroform ♏xx., mist. cretæ co. ℥j., every four hours. Diet, sago and milk. 5 p.m.: Temperature 101·4° Fahr. Had three motions in the day; the motions contained mucus and blood.

23rd.—5 p.m.: Temperature 102·6° Fahr. No vomiting; several stools in the day: they contain bloody mucus. Griping less than in the morning. Ipecacuanha and belladonna pills continued.

24th.—Several scanty fæculent stools in the night; very little slime. Temperature 98·8° Fahr. 5 p.m.: Temperature 100·4° Fahr. Several scanty stools in the day; the stools contain a little slime only. Dover's powder gr. x. h. s.

25th.—Several stools in the night; the stools consisted of mucus and blood. Griping increased. Ordered tinct. opii ♏xv., aquæ menth. pip. ℥j.; followed by pulv. ipecac. gr. xx. 5 p.m.: Temperature 98·4° Fahr. No vomiting. Several stools in the day; passed slime and blood. Griping excruciating. Infus. issofgool, pulv. Doverii gr. x. h. s.

26th.—Temperature 98·4° Fahr. Eight scanty fæculent stools in the night; very little slime in the stools; griping less than before. ℞. Ipecac. gr. j., opium gr. j., pil. j. ter die. Diet, half-rice, fish, milk. 5 p.m.: Temperature 98·4° Fahr. Five motions in the day, consisting of fæculent matter only, without slime and blood; griping much less.

27th.—Is just the same. No griping. 5 p.m.: Two well-formed stools, without slime or blood; no fever.

28th.—Doing well. From this date the patient never had any bad symptoms, excepting a recurrence of malarious fever, which was effectually checked by ten-grain doses of quinine.

Discharged cured August 12th, 1880.

Case 10.—Sloughing Dysentery.

Kulterah K., a Mahomedan male, aged twenty-eight, a labourer, was admitted into the Second Physician's Ward, Medical College Hospital, on April 8th, 1880, and discharged April 13th, 1880.

History.—Stated that he had been suffering from dysentery for the last twelve days.

Condition on Admission.—Is much emaciated; eyes sunken; pulse small, weak; tongue moist and furred. Had about ten or twelve stools, containing a large quantity of blood, flakes of mucus, and small bits of slough. No other complication.

Subsequent Progress and Treatment.—On admission a dose of castor oil with tinct. of opium was ordered, and pulv. ipecac. co. gr. x. at bedtime, and bismuth and ipecac. powder three times a day.

April 9th.—Stools five in number, and contain shreds of mucus, deeply tinged with blood. Retained the powders.

10th.—Mucus and blood less than before. Stools less in number.

12th.—There is no mucus or blood in the stools. Stools half-formed and bilious. He took his discharge the next day.

Native. Sloughing. Discharged after five days. Duration of disease until discharged, about seventeen days.

Case 11.—Sloughing Dysentery.

K., a Mahomedan male, aged thirty-five, a coachman, was admitted into the Second Physician's Ward, Medical College Hospital, on February 21st, 1880, and discharged on February 28th, 1880.

History.—Stated that he had been suffering from dysentery for the last twelve days. Passed several stools containing blood and mucus. Has had hiccough for the last five days.

Condition on Admission.—Is weak and much prostrated. Tongue moist and coated. Pulse small, soft, and weak. There is pain on pressure over the right hypochondriac region, as well as over the left iliac fossa. Stools several in number and very offensive; contain small bits of sloughs and shreddy mucus deeply tinged with blood. No splenic enlargement. Is getting hiccough nearly every five minutes. Cannot sleep at night. One pint of congee-water enema on admission; emplastrum sinapis over the diaphragm (its costal attachment); liq. opii sedativus ʒj. and mucilage ℥j., an enema at bedtime; and bismuth and ipecacuanha powder three times a day.

February 22nd.—Hiccough continues. Stools very offensive, and contain sloughs, mucus, and blood. Tinct. moschi, spt. æther, and spt. chloroform mixture ordered every two hours.

23rd.—Hiccough is not so troublesome. Stools less in number; mucus and sloughs and blood less. Opiate enema ordered twice daily.

24th.—Hiccough less. Three stools, containing bilious fæculent matter, with traces of mucus and blood; no sloughs.

25th.—No mucus in the stools, which are bilious, soft, and fæculent.

He improved in three days more, and took his discharge on the 28th.

Native. Discharged in eight days. Duration of disease, twenty days.

Case 12.—Sloughing Dysentery.

G., a native, aged forty-five, a clerk. Admitted May 27th, 1880, Medical College Hospital; died on May 31st. (Dr. McConnell.)

Has been subject to occasional attacks of looseness of the bowels, more especially during the past three months. Within the last few days (exact date not noticed) the disease has become truly dysenteric. The stools, seven or eight in

the twenty-four hours, are voided with much pain and tenesmus. Has been taking a good deal of opium lately (last two months) on account of the irritability of the bowels; is weak and emaciated; conjunctivæ muddy; tongue moist and furred; appetite lost; complains of pain over the right side of the abdomen, along the whole course of the ascending colon, and on manipulation there is a feeling of resistance and hardness over this portion of the bowel, while the left flank is soft and comparatively free from tenderness; no thoracic complication; no enlargement of spleen or liver.

After a small dose of oil guarded by tinct. opii, a few small rounded and hard scybala came away, with a little shreddy blood-tinged mucus.

May 29th.—Stools very frequent; contain much blood and shreddy mucus; no sloughs. The tongue has become dry. The hardness and tenderness of the abdomen is unrelieved, and there has been bilious vomiting three times to-day.

30th.—Vomiting of dark, thin, bilious fluid continues. The stools are less frequent, but of the same character.

31st.—Is fast sinking. Evacuations serous and bloody, involuntary. Mind wandering; apathetic. Died at 3 p.m.

Treatment.—Fomentations and poultices over the abdomen. Belladonna liniment applied over the course of the colon. Internally,—at first castor oil draught with opium, then ether mixture with tinct. opii: pulv. ipecac. in large doses; finally, sinapisms to the epigastrium and diffusible stimulants.

Post-mortem Examination (June 1st, 1880; eighteen hours after death).—Body emaciated and anæmic. Rigor mortis slight in the lower extremities; has passed off from the upper. Brain and membranes anæmic. Heart feebly contracted. Fluid dark blood and large, yellowish, soft coagula in right cavities, and small similar clots in the left; valves healthy. Lungs pale and anæmic. Liver somewhat small; substance firm; of deep yellow colour throughout, from uniform bile-staining. Bile-ducts dilated and filled with thick yellow

secretion. Lobular structure indistinct; seems anæmic. No reaction given with iodine. Gall-bladder about half full; duct free. Bile very thick and of dark reddish-brown colour; measures about half an ounce. Weight of liver two pounds twelve ounces. Spleen a little enlarged; substance soft and pulpy, of reddish-brown colour; weighs ten ounces and a half. Both kidneys somewhat atrophied, the renal substance yellowish from bile-staining. Weight of right, three ounces and three-quarters, of left four ounces. Stomach of normal size; mucous membrane slightly corrugated, throughout pale and anæmic. The mucous surface of the small intestine is pale and anæmic, except in the last two feet of the ileum, where it is abnormally vascular, injected, and marked by transverse bands or ridges of superficial ulceration, and invested by a thin granular layer or deposit of recent inflammatory exudation (lymph). The whole of the large gut is diseased. The cæcum, ascending and transverse colon show great thickening of all the coats, with a sloughy condition of the mucous membrane. The sloughs are large, greyish or tawny, easily detached from the sub-mucous tissues. In parts where they have thus become already detached, deep transversely placed ulcers are exposed, reaching to the muscular, and in some parts almost to the peritoneal coat. In the former case, the muscular tissue exposed is soft, shreddy, and pus-infiltrated; while the margins of the ulcers are thickened by the deposit of recent granular lymph. In the descending colon, sigmoid flexure, and rectum, these changes are not so marked; but the muscular coat and post-peritoneal cellular tissue belonging to and surrounding this portion of the gut, present a highly thickened condition. The mesenteric glands are enlarged, and on section found soft, swollen, and hyperæmic. The stomach contains half a pint of thin brownish fluid, with a good deal of partially coagulated milk; the small intestine about four ounces of thin brownish-yellow fæculent fluid, with a large number of small, dry, and hard scybala; the large gut only half an ounce of brownish semi-solid fæculent matter, and shreds of detached sloughs.

Case 13.—Suppurative Dysentery. (Dr. Cayley.)

O., a resident of Ninetollah, aged thirty, admitted into the Mayo Native Hospital on August 17th, 1880.

States that he has been suffering from symptoms of dysentery during the last ten days. About twelve days ago he had an attack of fever, two days after which he noticed bowel complaint. Daily he passed many stools, attended with much griping and straining. The stools contain chiefly slime. There is much tenesmus and griping. Tongue moist, but furred. On admission, the temperature was 100·4° Fahr. ℞. Tinct. opii ♏xv., aquæ menth. pip. ℥j. ℞. Pulv. ipecac. gr. xx., half an hour after the above. Diet, sago and milk. 5 p.m.: Temperature 103° Fahr. No vomiting. Has had six stools since morning; the stools are fæculent, but contain abundance of slime, without blood. Griping much less than the morning. ℞. Pulv. ipecac. gr. ij., ext. bellad. gr. ⅓, misce; ft. pil. j. t. d.

August 18th.—Temperature 100·4° Fahr. No vomiting. Five stools in the night; the stools are scanty, and contain gelatinoid exudation. 5 p.m.: Temperature 103° Fahr. Seven scanty stools in the day. Griping and tenesmus just the same as before. Ipecacuanha and belladonna pills continued. Turpentine stupes and fomentation over the abdomen.

19th.—Temperature 101·6° Fahr. Seven stools in the night; the stools contain slime and bilious secretions. Tongue furred. ℞. Tinct. opii ♏xv., aquæ menth. pip. ℥j. ℞. Pulv. ipecac. gr. xx., half an hour after the above. Cold compress over the abdomen applied. 5 p.m.: Temperature 102·4° Fahr. Five motions since morning, composed of soft yellow fæculence, with several portions of gelatinous exudation. There is pain and tenderness around the navel. Tongue coated in the centre. Griping distresses him much. No vomiting. ℞. Ipecac. gr. ij., ext. bellad. gr. ⅓, pil. j. ter die. Cold compress continued over the abdomen. ℞. Pulv. Doveri gr. v. h. s. Diet, sago and milk.

20th.—Temperature 102·4° Fahr. Countenance depressed

and anxious; pulse feeble; tongue furred. Seven evacuations, composed of a small quantity of liquid fæces, undigested milk, and much gelatinoid exudation, mixed up with shreddy sloughs. ℞. Ipecac. gr. ij., ext. opii gr. ss., pil. j. ter die. Cold compress continued. Diet, arrowroot and milk. Rum ℥ij. 5 p.m.: Temperature 103·4° Fahr. Seven stools in the day; the stools are mainly purulent. ℞. Pulv. ipecac. co. gr. x. h. s.

21st.—Temperature 100·8° Fahr. The patient is much prostrated. Passes stools in bed, which are like pus, and of highly offensive odour. Pulse feeble. ℞. Acid. carbolic. gr. j., opium gr. j., ter die. Diet, arrowroot and milk. Rum ℥iv. 5 p.m.: Temperature 102° Fahr. Several copious purulent stools in the day, of highly offensive odour. Pulse very feeble; voice low and husky. Griping distresses him much. ℞. Plumbi acetas gr. ij., ext. opii gr. ss., pil. j. h. s.

22nd.—Temperature 98·4° Fahr. Several firm but offensive stools in the bed-clothes. Pulse scarcely perceptible at the wrist. Body cold, bathed with clammy perspiration. Symptoms of collapse set in. Died about 8 a.m. of the same day.

Post-mortem Examination—Peritoneum of normal hue; no fluid in its cavity. Intestines more or less congested. The whole of the mucous membrane of the lower half of the ileum and large intestine was in an advanced state of inflammation, being of an uniformly pale rose-red colour, denuded of epithelium and covered with offensive, unhealthy pus. There were a few dysenteric ulcers near the ileo-cæcal valve. Nothing very particular with other viscera, except that the kidneys were enlarged.

Case 14.—Acute Dysentery and Liver-Abscess.

This case is the one represented in the drawing in the frontispiece.

Medical College Hospital, Calcutta.

G., a Hindoo, aged twenty-four, admitted August 7th, 1880; died August 16th, 1880.

and anxious; pulse feeble; tongue furred. Seven evacuations, composed of a small quantity of liquid fæces, undigested milk, and much gelatinoid exudation, mixed up with shreddy sloughs. ℞. Ipecac. gr. ij., ext. opii gr. ss., pil. j. ter die. Cold compress continued. Diet, arrowroot and milk. Rum ℥ij. 5 p.m.: Temperature 103·4° Fahr. Seven stools in the day; the stools are mainly purulent. ℞. Pulv. ipecac. co. gr. x. h. s.

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Medical College Hospital, Calcutta.

G., a Hindoo, aged twenty-four, admitted August 7th, 1880; died August 16th, 1880.

Had diarrhœa for a month, culminating in dysentery with fever during the last seven days; is weak and anxious-looking. Great pain over lower part of abdomen, which is hard and tender to the touch, especially at one spot, about three inches below the right costal arch, in the course of the ascending colon, where also a distinct tumour-like thickening of the bowel can be felt almost the size of the closed fist. It is dull on percussion. The stools are very frequent; ten to twelve in twenty-four hours, and passed with much griping and straining. They consist of soft fæculence, with branny mucus and blood.

August 8th.—Thirteen stools in last twenty-four hours; abdominal tenderness increasing; urine scanty. Temperature 100° Fahr.

9th.—Several dark sloughs passed to-day, and the tumour-like swelling in the abdomen is diminishing.

12th.—Seven to eight stools in twenty-four hours; no more sloughs; a little fæculence and blood.

14th.—Patient weak; fever increasing. Twelve stools to-day; fæculent and bilious.

15th.—To-day the stools contained a few more pieces of slough and gelatinous mucus; nine stools during the night; pain in abdomen much less. Evening: Has had ten evacuations during the day; countenance very worn and anxious; pulse small and weak; extremities cold. The tumour has entirely subsided; gurgling on pressure in the right iliac fossa.

16th.—Sub-normal temperature 96·4° to 97°; pulse thready. Twelve stools during the day; contained sloughs. Body bathed in sweat. Sank gradually, and died at 8·45 p.m.

TEMPERATURES.

1880.	Morning.	Evening.	1880.	Morning.	Evening.
Aug. 7 ..	98·4°	99·0°	Aug. 12 ..	99·0°	102·0°
,, 8 ..	99·0°	100·0°	,, 13 ..	98·4°	102·0°
,, 9 ..	98·4°	100·0°	,, 14 ..	99·0°	102·0°
,, 10 ..	99·0°	100·2°	,, 15 ..	98·2°	100·6°
,, 11 ..	98·4°	102·6°	,, 16 ..	96·4°	97·0°

Treatment.—Pulv. ipecac., sod. bicarb., bismuth., āā gr. v. ter die. Anodyne enema bis die. Equal parts of iodine and belladonna liniment rubbed over thickened bowel; hot fomentations over abdomen. The ipecacuanha was replaced by Dover's powder after a day or two; then acetate of lead gr. v., opii gr. j., in pil.; lastly, diffusible stimulants.

Post-mortem Examination (August 17th, 1880; twelve hours after death).—Body emaciated; rigor mortis slight. Brain-substance pale, anæmic, much softened. Lungs: Anterior portions pale and anæmic; but the margins and bases dark and congested; the lower lobes œdematous. Heart feebly contracted; fluid dark blood with small fibrinous clots in right cavities; a little fluid blood in the left; muscular tissue pale and soft. Abdomen: Small intestines much distended with flatus, their walls unusually thin and translucent. The transverse colon is seen glued to the under surface of the liver by a little recent lymph. There are similar soft recent adhesions between the liver and diaphragm and between the transverse colon and duodenum; and about two ounces of opaque turbid serum effused into the general peritoneal cavity. Liver of about normal size; weight 2 lbs. 15½ ozs. Both upper and lower surfaces are covered with soft projecting nodules, seen on section to be abscesses. They vary in size from a hen's egg to a hazel-nut, and on incising the liver are seen also thickly distributed throughout the parenchyma of both lobes. Each abscess is distinctly circumscribed, is surrounded by a bright hyperæmic zone, and contains a varying quantity, from a few drops to half an ounce, of thick, glairy, greenish-yellow pus. Such portions of the liver-substance as remain unaffected are soft and greasy. The lobular structure indistinct. No reaction under iodine. Gall-bladder about a third full; duct free; bile thick, reddish-yellow; measures a little over two drachms. Spleen a little enlarged. Capsule much thickened and opaque; adherent to the surrounding parts. Substance moderately firm. The trabecular structure throughout much hypertrophied. Weight 7¾ ozs. A good deal pigmented at the periphery. Kidneys a little congested; nothing else

remarkable. Stomach small and contracted. The mucous membrane a good deal congested, pale, and anæmic. That of the small intestine also pale and anæmic, but stained yellow from bile. The ileum throughout is much thinned. The ileo-cæcal valve has been partially destroyed by ulceration. The whole of the cæcum presents a thickened, puckered, and ulcerated condition. The mucous membrane of the rest of the large intestine is highly swollen and œdematous. A little below the hepatic flexure of the colon is a very large transversely placed ulcer, its margins covered with recent creamy inflammatory exudation (lymph); and the rest of the gut is thickly covered by transversely placed ulcers and sloughs, the majority also showing a granular recent deposit of lymph at their margins and bases. The sub-mucous and muscular coats of the bowel are enormously swollen and œdematous, very much thickened over the whole ascending colon, and especially rigid in the neighbourhood of the large ulcer therein found above described. The whole intestine is contracted in calibre, abnormally firm, rigid, and shortened. The mesenteric glands are not affected. The stomach contains about two ounces of milky fluid; the small intestine about six ounces of brownish, thin, muco-fæculent fluid; the large gut about half an ounce of thin, highly offensive fæculence, with one large dark slough and numerous small fragments or shreds of others.

I am indebted to Mr. Alban Doran, of the Royal College of Surgeons, for the following report on the microscopic examination of the so-called abscesses of the liver of this case:—

"I selected a small piece of hepatic tissue, close to the surface of the liver, which included a spherical white lump, firm throughout. The liver-substance around it was of the normal colour and appearance; the surface was slightly puckered over the white lump.

"Sections of this piece were cut, after hardening, by Dr. Vincent Harris, in the Physiological Laboratory of St. Bartholomew's Hospital; the freezing microtome was used for this purpose. The section here shown was stained with

logwood. I then examined this section, and found the following appearances:—

"In the midst of the white mass (Fig. 1) I distinguished a cloudy or faintly granular matrix, containing a few liver-cells, some with their outlines tolerably distinct (*a*), others much broken down (*b*); so that I suspect the granular matrix may be made up of *débris* of liver-cells. More distinct than these cells were elongated bodies (*c*), of the shape of cells seen in young connective tissue, only none were so

distinct. I could not detect a nucleus in any; and when seen in a mass, under a low power (Fig. 3), they had a fibrillated appearance. The exact nature of these bodies is uncertain; they possibly represent fibrillation of new connective tissue, or may have been artificially produced by the action of the hardening medium on the not quite absorbed fluid part of an old abscess. The portions of the section which included the border of the white mass showed the fibre-like or spindle-cell like bodies very indistinctly (Fig. 2),

large and perfect liver-cells (*a*) predominating, whilst some of these were undergoing degeneration (*b*). The appearance of the section at the extreme limit of the white mass, and close to the most evidently normal part of the true liver-substance (Fig. 4, *a a a*), shows the morbid change (*b c*, same as in Figs. 1, 2, and 3) in a still earlier condition.

"It is at least clear that the morbid action has taken place amidst the true liver-cells, and never displaced them, but simply destroyed them in their places, for the *débris* of these cells may be distinctly traced in the deepest part of the white mass. They appear, in fact, to have broken down from acute local inflammation; the cells (*b*, Figs. 1 and 2) being homologous to the 'cloudy' and swollen cells in tubal nephritis. No true leucocytes can be found, hence exudation from the vessels must have been very slight."

The following cases at the Campbell Hospital, Calcutta, were under the care of Surgeon Khan Bahadoor Tameez Khan, Physician to the Hospital.

Case 15.—Acute Sloughing Dysentery, complicated with Enlarged Liver and Spleen.

N., aged thirty, a Bengalee Hindoo, admitted September 15th, in the First Medical Ward of the Campbell Hospital, with symptoms of dysentery. Patient, a fisherman, resident of Chingree Ghatta, a most unhealthy locality, exposed to constant malarious exhalations of the salt-water marshes to the south-eastern end of Calcutta. He is a dissolute-looking, weak-constitutioned, and emaciated person, very intemperate; is in the habit of drinking country liquor (arrack), and eating decomposed salt fish. In consequence of irregular habits and intemperance, he has been subject to occasional attacks of dyspepsia, with acidity, flatulence, nausea or vomiting, followed by looseness of the bowels. He has also suffered from repeated attacks of malarious fever, and has a greatly enlarged spleen. About a month and a half ago,

having indulged too freely in salted fish, and drunk too much "arrack," he placed himself under a koberaji's (native doctor's) treatment. Obtaining no relief, and finding he was suffering from dysentery, he came into hospital. Was then having from six to eight motions in twenty-four hours, attended with much tormina, but no tenesmus. The motions were liquid and fæculent, but contained no blood or mucus. In the left lumbar region and left iliac fossa there was intense pain, aggravated on pressure. No signs of febrile disturbance. Pulse small, weak, and frequent; tongue clean and reddish; had no appetite; much nausea; micturition not difficult. Was ordered castor oil ʒiv., laudanum 5 drops, peppermint-water ℥ss.—draught. Diet, milk and rice.

September 17th.—Had many dejections containing mucus and blood, but no fæcal matter. Pain and hardness in the left iliac and lumbar regions have much increased, and render him unable to strain. Had no fever. ℞. Dover's powder gr. v., ipecac. powder gr. iij., bismuth gr. v., and gum acaciæ powder gr. v.—to be made a powder, to be given thrice a day. Frequent linseed-meal poultices over the seat of pain. Diet, milk and rice.

18th.—Has had a great many stools in the last twenty-four hours, consisting of copious dark reddish-looking fluid, in which were found floating small masses of dark-greenish and brown frothy fæculent matter. No fever. Pulse small and weak. Pain much the same. Complains of griping, but no straining. Same medicine and diet.

19th and 20th.—Calls to stool increasing in frequency—ten or twelve in twenty-four hours. The stools consist of small quantities of greenish-yellow fæculent matter, with copious blood and mucus. No fever. Pulse weaker. Has hiccough. Is seen lying frequently on his left side, with his hand pressed over the left side of his abdomen. Tormina but no tenesmus at stool. Same medicine. Opium enema. Milk and bread for diet.

21st.—Many stools since last report. Passes a quantity of dark-reddish fluid, but no fæculent matter. Stools being washed, large masses of dark blood-clots, as well as innumerable

red-stained branny sloughs and some gelatinous mucus, were seen. Has been very restless and sleepless. Countenance anxious and pinched. Has vomited once. Hiccough very troublesome. No febrile reaction. Pulse very small and weak. Tongue dryish and covered with a brownish fur. Has passed urine freely. Abdominal pain continues, but has felt easier since the opiate injections were given. Continued the medicine and opium injections. Acetate of lead gr. x. in each injection. Poultices over abdomen. Milk and bread; rum two ounces.

22nd.—Worse and very weak. Had many stools consisting of a copious reddish fluid, highly offensive, with a little yellow fæcal matter. On washing, clots of blood with grey-coloured shreddy sloughs in abundance were found. Pain in the left iliac fossa and left lumbar region is severe. A cylindrical hard mass is perceptible. No febrile reaction. Pulse very weak and low. Vomited once; hiccough troublesome; had very little sleep. Takes no nourishment. Omit ipecac. Continue the injections and poultices. Rum ʒiv., aromat. spt. ammon. ♏xx., decoct. of koorchee ℥ss., every six hours.

23rd.—Is quite prostrated; countenance pinched and shrunken. Had no fever. Had only two motions within last twenty-four hours, but the pan contains more than four pints of dark-reddish thin liquid, of a highly putrid odour. On washing, large clots of dark grumous blood, with numerous fragments of black slough, were found. Surface cold and clammy. Pulse excessively small and thready. Abdominal pain hardly complained of, but patient shrinks when pressed in the left iliac fossa, where hardness is still perceptible. The same stimulant, enemata, and poultices were ordered to be continued. Was also ordered to have gallic acid gr. viij., dil. sulph. acid ♏x., liq. opii sed. ♏vij., decoct. koorchee ʒss., every six hours, with the stimulant and diet as before.

24th.—Temperature 98·4°; pulse 46; respirations 19. Said to have had only four motions in last twenty-four hours, consisting of dark, grumous, sanguinolent liquid, which on washing was found to contain clots of blood and

many pieces of dark charred slough of a highly offensive odour. There is griping as well as straining; the pain in the left iliac and lumbar regions is less; pulse very small and thready; vomited once; hiccoughs occasionally. For the first time since admission patient is reported last evening to have had a slight febrile accession. Temperature 99·4°.

25th.—Last evening, again, there was some febrile disturbance—temperature 99·4°, but this morning it is normal; pulse excessively weak, small, and thready; tongue moist and clean; a cadaveric odour is exhaled from his body. Twice moved only during the last twenty-four hours; motions consisting of thin, dark, grumous blood, no clots, but black sloughs were found in the bottom of the pan; abdominal pain much the same; the hard swelling in the left iliac fossa gives a dull sound on percussion, and continues to be very painful. Has been very restless, had no sleep; hiccough incessant; no vomiting; took very little nourishment. Medicine continued. Diet, milk two pints, rum two ounces.

26th.—Is worse. Last evening the temperature was 99°, but this morning it is rather below normal. Had no sleep, and was very restless all night; has passed several scanty, highly offensive, and dark chocolate-coloured motions in bed; hiccough incessant; refuses medicine and food; pulse fluttering. A small draught composed of some tincture of belladonna and chloric ether was given to relieve the urgency of the hiccough—to no purpose. Tongue dry and brown. Turpentine stupes. Diet same.

27th —Patient is in a state of unconsciousness. Skin cold and covered with clammy sweats; pulse barely perceptible; has passed several motions in the bed-clothes, which are stained of a dark-reddish and greenish colour, highly fœtid. To have rum and milk occasionally, and stimulants.

Died at about 1 a.m. of the morning of September 28th.

Post-mortem Examination.—Body much emaciated; no rigor mortis present. Head not examined. Chest: Both the lungs were firmly adherent to the thoracic walls by old and firm fibrinous bands. On section, the lung-substance appeared to be of a dusky reddish colour, and non-crepitant.

The lower lobe of the left lung, on its posterior aspect, was much congested, and of a bluish-red colour; section firm and non-crepitant. Bronchial tubes empty; their lining membrane pale. No pericardiac effusion. Heart small and atrophied. Both the right and left ventricles contained softish decolorized clots; that on the right side was seen to be prolonged into the interior of the larger-sized branches of the pulmonary artery. Valves and endocardium apparently healthy. Abdomen: In the right side of the abdominal cavity a small quantity of serous exudation was present. Liver much enlarged; a portion of the anterior edge of the right lobe was found adhering to the upper portion of cæcum, and the left lobe was adherent to the spleen below and the diaphragm above. Just towards the anterior edge and upper surface of the liver, and located just above the fundus of the gall-bladder, a perfectly white and sacular swelling of about the size and form of a hen's egg was seen. The walls of the sac were traversed by fine red blood-vessels. On opening the sac, about three or four drachms of a curdy, yellowish purulent matter, precisely similar in colour and consistence to the matter from strumous abscesses, issued. The inner wall of this small abscess was lined by a small and even membrane. Liver capsule somewhat thickened and opaque. Liver parenchyma somewhat coarse, granular, and softish, and of a pale red colour. Within the portal vein, from its commencement in the transverse fissure to about three or four inches within the hepatic parenchyma, a large dark clot of blood was found; gall-bladder was full of apparently healthy bile. Spleen considerably enlarged and extensively adherent to the diaphragm, to the left lobe of liver, to left kidney, to the splenic flexure of colon, and to portions of omentum. Its capsule was densely thick, white, and of a semi-cartilaginous consistence. Its parenchymatous structure soft, and of dark grumous colour. Kidneys appeared to be congested. The lower third of the small intestine was in a congested state; particularly the portion of ileum near the cæcum. Many of the coils of the small intestine were adherent to each other, and above to the transverse colon.

The large intestines were much dilated, and their coats, particularly those of the cæcum, considerably thickened. It has already been noticed that a portion of the lower anterior edge of the liver was adherent to the cæcum. The latter, immensely thickened, was adherent anteriorly with the abdominal walls, behind to the iliac fossa and psoas and iliacus muscles. The hepatic flexure of colon was firmly adherent to the under surface of the liver; its transverse portion to the stomach and pancreas behind; its left curve was adherent with the spleen. The jejunum was adherent to the transverse colon, a spot of which was found about to open into the adherent small gut; the spot was covered with a layer of soft yellow lymph. The lowest portion of the descending colon, and the upper part of the sigmoid flexure, were also in a similar condition, and had just escaped perforation. The vermiform appendix had a dark and charred appearance, was twisted upon itself, and was adherent to the dilated portion of the cæcum. On laying open the large intestines, the whole of the internal surface was a mass of ragged, disintegrated, charred, and black débris of slough. In most places not the slightest vestige of the mucous or muscular coats was to be seen. Here and there whole portions of these coats were left behind in the wreck. There, and beneath them, and between the still intact serous coat, quantities of dark-coloured, sanious, and highly putrescent diffluent substance was seen to infiltrate and burrow underneath the coats to some distance. The inner coats of the large intestines were so completely destroyed by gangrene, that nowhere could any definite outline of ulcers be seen. The vermiform appendix presented the same black and charred appearance in its interior. The ileo-cæcal valve was also involved in the gangrenous process. A few circular scooped-out ulcers were met with within a few inches of the termination of the ileum. The mucous coat of both the stomach and duodenum was much congested and softened.

Case 16.—Sloughing Dysentery, with Discharge of a Very Large "Tubular Slough"—Complete Recovery.

Campbell Hospital; under the care of Khan Bahadoor Tameez Khan.

S. K., an Afghan, a native of Cabool, aged about fifty-eight years, a petty dealer in clothing, etc., came to Calcutta in November, 1879. He has been constantly exposed to vicissitudes of temperature, and has slept in the open verandah of a very damp house. His food has been poor, and the drinking-water in the locality where he resided was not good. Being an orthodox Mahomedan, he has never taken spirits or any intoxicating drug. A fortnight before admission he had an attack of malarious fever, of a quotidian type, contracted in Burdwan. This compelled him to quit that place and come down to Calcutta. Prior to admission, he was suffering also from constipation, for which he took an aperient, with little effect. The same evening he ate heartily of beef and wheaten cakes. During the night succeeding he suffered from griping pain in the abdomen. The next day, to clear his bowels, he took another aperient, and again in the evening indulged in food. Since then (eight days ago) he has been suffering from dysenteric symptoms. He appears to be weak, but is a wiry, thin-built elderly man. Has very frequent and scanty motions, consisting of blood and mucus, without fæculent matter. There is much griping and straining, and severe pain in the left iliac region. Micturition is difficult. He has daily paroxysms of fever from about 2 p.m., which last fourteen or fifteen hours, intermitting at 4 a.m. Countenance anxious; tongue clean and moist. There is nausea, but no vomiting. Has no appetite. Pulse soft and small; temperature not taken. Has neither pain nor fulness in right hypochondrium. To have p. ipecac. gr. v., p. ipecac. co. gr. iij., bismuth gr. v., p. gum acaciæ gr. v.—one powder every eight hours. Anodyne injections twice a day. Diet, milk and rice.

September 6th.—Two of the three doses of medicine given

were rejected. Patient felt much relieved since he had the injections and powders, and slept better than he had done lately. In the motions some small masses of fæculent matter were noticed in the dejecta. Had the febrile paroxysm as usual. Upon the whole he feels better, but is very weak. Continued medicines. Diet, spoon; milk two pints, rum two ounces.

7th.—Is worse and very low. Had many motions, which are quite liquid and of a reddish meat-washing colour; mucus and much clotted blood. Griping and straining severe. Pain in anus is also complained of. Fever came on about 10 a.m., with rigors and chills, and left at 2 p.m., with sweating. Tongue dry and clean. Has vomited twice. No appetite. Pulse very weak. Same medicine, same diet.

8th.—Much the same as on last report. Febrile paroxysm as usual. Had from twelve to fourteen motions of the same nature as last reported, but they again contain some yellowish fæcal matter. Has much straining and pain in anus; griping pains are complained of in abdomen also; difficulty in micturating continuing as before. Was not so restless last night, and had some sleep. Appetite better. Continue the medicine. Turpentine stupes over abdomen.

9th.—Fever came as usual. Had twenty motions during the last twenty-four hours—thin; colour and consistence as above noted. He is weaker. Medicines and diet continued.

10th.—Fever less; lasted about four hours only. He looks better. Had about twelve or thirteen stools in the last twenty-four hours; not copious, consisting of brownish, semi-liquid, fæculent matter, without any traces of blood or mucus. Griping less, but straining and pain in anus continue. Has no difficulty in passing water now. Pulse very weak and feeble. Less pain in the left iliac fossa. Inclined to eat a little. Looks cheerful, but is very weak. Omit ipecac. Gallic acid gr. v., cinchona alkaloid gr. iij., dilute sulph. acid gr. x., liq. opii sed. ♏vj., rum ʒij., decoct. koorchee ʒij.—mist., make a draught—once every three hours. Continue opiate enema and turpentine stupes. Spoon diet; milk two pints, rum two ounces.

11th.—Had no fever during the last twenty-four hours. Had twenty-four grains of the cinchona alkaloid. Frequency of calls to stool increased, but in character and consistence stools same as last reported. A long tubular dark grey coloured slough is seen protruding out of the anal orifice. It is highly offensive, and seems to be still firmly attached above. Patient is very low; pulse very small and quick; skin cold, covered with clammy sweat. Towards the evening had slight febrile reaction. Continue same medicine; same diet.

12th.—Number of motions passed during the last twenty-four hours much less (only five); they are of a thick syrupy consistence, and of a greenish-yellow colour. On the surface some purulent matter is observed; no blood or mucus seen. The protruding mass of slough has not separated, but, owing to constant straining, it has protruded more, and is about a foot long; looks of a dark grey colour, and emits a highly putrid, gangrenous odour. On washing the stools, another small shreddy and jagged black-coloured slough was found in the bottom of the pan. Temperature normal; skin cooler; pulse feeble; no pain in iliac region. No hiccough or vomiting. Tongue moist and clean. Appetite better. Continue medicine. Milk and bread diet; mutton broth; rum.

13th.—Had slight fever last evening for about three hours, which has left with sweating. At present, temperature normal. The protruding slough has separated. He looks easy and comfortable. Abdomen soft and retracted, free from pain. Had seven stools during the last twenty-four hours. Motions fæculent, some of an ochrey-yellow colour; no traces of blood or mucus to be observed. Pulse small, soft, and steady. Tongue clean and moist. A peculiar fishy odour is exhaled from his person. Continue medicines. Body to be sponged with tepid water and Condy's fluid. Diet same.

14th.—Much the same as yesterday.

15th.—Had slight pain. Bowels moved ten times. Motions more consistent, fæculent, and of a yellowish-drab colour. On washing the dejections, a jagged, irregular slough, about three inches long, quite tubular, of smaller diameter than the

first, was found amongst the fæculent mass. Has no griping, straining, or pain in abdomen; no hiccough; no pain about the anus. Appetite very good. Continue medicines. Omit opium enemata; substitute opium suppositories. Diet, milk and bread twice a day; extra milk one pint, rum two ounces.

16th.—Had slight fever last evening. Bowels moved eight times during the last twenty-four hours; dejections fæculent and pultaceous, of a yellow colour; no traces of blood, mucus, or sloughs to be seen. Says he feels pain in anus, and has a throbbing sensation within abdomen, just about the umbilicus. Pulse soft and steady. Tongue moist and clean. Appetite good. Slept well. The same medicines and diet.

18th.—Much the same as reported last; but the number of fæculent and pultaceous motions seems to be increasing. Has a voracious appetite; is continually asking for more food. The same medicines, with gallic acid two grains, and liq. opii sed. two drops, in addition, in each dose. Diet the same.

19th.—Had twelve motions since last report; colour and consistence much the same as reported before, but the two stools he had last appear to have a coating of yellowish purulent matter over their outer surface—purulent matter, but mixed with fæces. Has no griping or straining; no pain on pressure anywhere on abdomen; no pain or uneasiness in right hypochondrium; feels very comfortable and easy; appetite very good. Same medicines; the same diet, with extra amount of soup.

20th to 23rd.—Patient has been gradually and steadily improving. His appetite is excessive; he is not satisfied with the quantity of food he gets. Has been having from seven to ten motions in the day, but they are becoming more consistent, fæculent, of a yellowish colour, and do not contain any blood, mucus, or sloughs, but occasionally a few drops of purulent matter is to be seen on the surface of the stools. Has not been feverish lately; no griping or straining; no pain in abdomen; no uneasiness in anus; pulse gaining strength. Medicine and diet the same.

24th.—He is feeling comfortable, and is steadily improving.

Medicines continued. Diet same; extra rice (boiled) eight ounces.

25th.—Owing to sudden change in the weather, he felt feverish last evening. Temperature 99·6°. Number of motions diminishing. In all other respects seems to be improving. The same medicines and diet.

26th.—Improving. Motions getting thicker; no traces of pus noticed. Same medicines. Milk and bread diet; mutton curry and buttermilk eight ounces. Omitted gallic acid; aromatic chalk with opium gr. xx. every six hours.

28th.—Patient is doing well, but looks pale and anæmic. Number of stools considerably reduced, and their consistence increasing. Some pus has appeared in the motions. He was ordered to have an injection, composed of half a drachm of alum dissolved in four ounces of cold water, twice a day. He was further ordered to have thirty drops ferri pernitrat. twice a day. Diet the same as before.

30th.—Improving.

October 1st.—Henceforward to October 12th he continued to make a steady progress towards recovery. He gradually gained strength, lost his pale and bloodless aspect, had a very good appetite. The number of motions became less, and firmer in consistence; the purulent discharge disappeared.

He was discharged cured on October 15th.

Case 17.—Asthenic Dysentery, with Hæmorrhoids and Enlargement of Spleen.

Campbell Hospital.

A. A., aged forty, a ship Lascar, native of Eastern Bengal, admitted on September 1st, 1880. Very weak and emaciated. Has suffered from prolonged malarious fever; has enlarged spleen; and for the last two weeks has passed seven or eight stools daily, which, he says, consisted of mucus, blood, and some fæculent matter. They were attended with tenesmus and griping, whilst there was a constant griping pain about

the umbilicus. He also suffers from internal hæmorrhoids, which occasionally bleed freely.

Has no fever at present; pulse small and soft; skin dry and harsh; tongue moist and clean; no appetite. Three days after admission the calls to stool increased to fourteen or sixteen daily, the evacuations consisting of reddish and yellow liquid fæculence with blood-clots, but no mucus; pain on pressure over sigmoid flexure; tenesmus had increased; the left eye is painful, with profuse lachrymation and photophobia.

September 5th.—Is feverish. Less frequency of action of bowels; stools eight to ten in twenty-four hours, of the same character as yesterday. Pain on pressure over splenic flexure of colon.

6th.—Is weaker. Twelve stools during last twenty-four hours, of an ochrey-reddish colour; on washing these, fæculent branny sloughs were detected. Tenesmus and tormina considerable. Fever came on last night. Left eye is painful, and the lower segment of the cornea is opaque. The other eye is cataractous. Straining is severe, and has produced prolapse of the bowel. Temperature normal. Tongue clean and moist. Does not sleep and has no appetite.

Up to the present report he has been taking five-grain doses of euphorbiaceous extract three or four times a day, but with no apparent benefit. Now he is to have gallic acid gr. v., cinchona alkaloid gr. iij., dil. gal. acid ♏x., liq. opii sed. ♏x., rum ʒij., decoct. koorchee ʒvj., every six hours. Belladonna and cotton-pad for the eye. The next day he was easier and slept better. Motions less frequent. No fever. Eye less painful.

8th.—Number of stools again increased. Motions highly offensive, and contain clots of blood. Straining and griping less. Micturition difficult. Continue all as before.

10th.—Free from fever. Motions more frequent in the last forty-eight hours. Is weaker; unable to rise from his bed. Dejections of a reddish colour. There is pain in the left iliac region. Tongue dry. Looks dull and heavy. Pulse very feeble. No appetite.

11th.—Eight or ten motions in the past twenty-four hours, of a reddish colour. Blood-clots and shreds of slough also present. In the afternoon, after the bowels had acted, he became collapsed, and sank early next morning.

Post-mortem.—Body emaciated. Œdema of feet. Head not examined. Chest: Lungs slightly adherent to thoracic walls by old adhesions; crepitant and healthy. Heart: No pericardial effusion; natural in size; muscular substance pale and flabby. Right ventricle contained a large decolorized fibrinous clot, extending into the pulmonary artery; left ventricle contained a small loose clot of blood. Valves and pericardium apparently healthy. Abdomen: Liver of normal size; texture firm, but of a pale colour. Gall-bladder full. Spleen much enlarged; its capsule thickened; trabecular structure firm and dense; pulp very soft and dark. Kidneys apparently healthy. Intestines: Ileum in a state of hyperæmia, but not ulcerated. The whole of the large intestine highly congested. Numerous ulcers, some circular, some irregular with jagged edges, affecting *only* the mucous membrane, occupied the mucous membrane throughout, but most in the sigmoid flexure and rectum. The muscular coat appeared to be unaffected. The peritoneum was healthy. The hæmorrhoidal vessels, varicose and dilated, contained dark blood-clots.

Case 18.—Dysentery with Renal Disease.

Campbell Hospital.

M. C. D. B., aged thirty-five to forty, admitted on August 8th, 1880, and discharged on September 17th, 1880. He is a village chowkedar (watchman). Had been exposed to night air and vicissitudes of weather. Had not been in the habit of drinking. Never had rheumatism or any eruptive disease.

Some years ago had an attack of dengue, and had hurt his loins by a fall, since which time he has been subject to severe lumbar pain.

Three months ago he had a severe attack of remittent fever, and when recovering, dysenteric symptoms set in. For this he had been living on dhai (curds—a native article of diet), but had taken no medicine. He was improving, when suddenly he became anasarcous and ascitic, in which state he was admitted. There was great dyspnœa. Face puffy; whole body, limbs, and scrotum œdematous. Urine scanty, very albuminous, and contained granular and hyaline casts, and there were frequent evacuations of blood and mucus, with tormina and tenesmus. There were daily returns of fever, which intermitted towards evening. Ipecacuanha and bismuth were given, but with no relief; gallic acid, with opium and koorchee, were then prescribed, and under this treatment the symptoms rapidly abated. The evacuations became healthier and less in number; the griping and tenesmus diminished; the abdominal pain and the fever disappeared.

The anasarca was also greatly relieved by punctures, as much as sixteen pints of clear serous fluid flowing from them in twenty-four hours. The drain continued for some days, and gave great relief. Iron was then given. The improvement continued so much that on September 17th he was discharged.

The history of this case is not known after he left. It is to be feared that the relief may only have been temporary; but it is interesting as showing the complication of renal disease, and the amount of relief that was afforded.

Case 19.—Dysentery with Fever—Enlarged Spleen.

Campbell Hospital.

J., aged nineteen, Hindoo labourer, from the North-West Provinces; of intemperate habits. Admitted July 9th, 1880, died August 17th, 1880.

Three months previous to admission suffered from malarious fever and enlarged spleen. As he was getting worse he was

sent to hospital. Besides the usual symptoms of intermittent, and greatly enlarged spleen, there was extensive pleuritic effusion into the pleural cavity on either, but most on right, side. There were also dysenteric symptoms of severity. For a day or two after admission he had six to eight scanty muco-sanguineous motions; they soon increased to fifteen to twenty daily. They were mingled with more or less semi-liquid fæculence. At first he did not complain much of tormina or tenesmus; latterly they became urgent, and he was distressed by severe pain, as if some foreign body were in the rectum, especially in the evening. There was daily recurrence of fever, dyspnœa, and cough, which, after a time, was attended with muco-purulent expectoration; inability to lie down, excessive debility, feeble rapid pulse, indicated his precarious state. There was now little or no pain in the abdomen or hepatic region. On washing the dejections they were found to contain small pieces of pus-infiltrated greyish sloughs, some being of a black colour. For a few days he took ipecacuanha, bismuth, and Dover's powder; but they did no good, and were substituted by gallic acid, opium, and koorchee. Opiate enemata were also administered, but he could not tolerate the syringe. Suppositories were given instead, with good effect. He got weaker, however, and was supported as much as possible by nutriment and stimulants. The dysenteric symptoms and the fever abated; but collapse and apnœa set in, and he died. No surgical attempt had been made, on account of the debility, to remove the fluid from the chest.

In addition to the usual post-mortem appearances found in cases of pleuritic effusion, and a very much enlarged spleen, there was nothing very unusual in the appearance of the serous surface of the intestines. The ileum did not appear to be much congested. The calibre of the large intestine seemed to be narrowed. On laying open the gut the mucous membrane of the large intestine was found to be of a slate colour, and ulcers of various sizes existed there, especially in the sigmoid flexure. Two large oval ulcerated patches were met with just at its lower ter-

mination, and it was apparent that all down to the serous coat was destroyed. There were puckered cicatrices of old ulcerations, contracting the bowel, seen here and there. Spleen greatly enlarged. Liver also enlarged, and appeared to have undergone fatty infiltration.

Note.—The state of the heart is not noted, but no doubt the right side and the pulmonary artery were plugged with white fibrinous clots, and that *they* caused the breathlessness and collapse which preceded—indeed actually caused—death.

Case 20.—Sloughing Dysentery and Cirrhosis of Liver.

Campbell Hospital.

B. G., aged twenty-six, a Hindoo labourer, admitted on September 13th, 1880. Has been in the habit of drinking rum for the last four or five years. When he was in his native country, the North-West, he was in the habit of drinking spirits distilled from mahooa (*Bassia latifolia*). For the last three months he has been out of health, with general weakness, and for six weeks from dysenteric symptoms and quotidian fever. At first he had loose fæculent stools, but lately the motions have increased in number, and are mixed with mucus and blood, attended by tenesmus and severe pain in the lumbar and right iliac regions; the latter is tender on pressure. His skin is cool; tongue clean and moist. Has long lost appetite, and suffers from acidity, nausea, and vomiting. Pulse very slow and weak—in the right wrist forty-one beats, and in the left thirty beats per minute were counted. Passes urine freely. Heart's action excessively weak and slow. Area of hepatic dulness, both upwards and downwards, considerably diminished—so much so that the space occupied by the seventh and eighth ribs appears to be the only dull spot in the right hypochondrium. There is atrophy of liver, and no perceptible enlargement of spleen. Was ordered—p. ipecac. gr.

iv., p. ipecac. co. gr. vj., bismuth gr. v., gum. acaciæ gr. v.—misce; one powder, once every eight hours. Turpentine stupes. Milk and rice diet.

September 16th.—Had about forty-eight motions during the last twenty-four hours, perfectly liquid, and in colour and consistence like "meat washings." In the liquid are seen floating some yellow-coloured fæces, covered with a coating of mucus. On washing, numerous small scaly and branny sloughs of a grey colour and some clots of dark blood with mucus, like boiled grains of sago, were seen. Had no fever; is very weak; pulse 44. Tenesmus, with pain, fulness, and hardness in the right iliac fossa. Has vomited four times, and brought up two living lumbrici. Has passed small quantities of urine with the motions. Medicine continued. Spoon diet; milk two pints.

17th.—During the last twenty-four hours has had numerous stools—number not counted. Motions not quite so liquid as before; of a dark colour and very offensive. A few small masses of yellow-tinted casein are seen floating. On being washed, numerous thin branny sloughs, with clots of blood and some lumps of gelatinous mucus, were seen in the dejections. He says that there is violent straining and griping. Pain and much tumefaction with some induration in the right iliac region. No fever within the last twenty-four hours. Had no sleep and was very restless. No appetite. Tongue moist and clean. Pulse exceedingly small, weak, and slow. Morphia sleeping draught at bed-time. Spoon diet; milk two pints.

18th.—Had no fever. Frequency of calls to stool less; had only twelve during the last twenty-four hours. Motions consist of copious yellowish-coloured liquid, covered with green-tinted frothy matter. On washing the excreta, a few blood-clots but no sloughs found. Micturition easy. Slept better. He looks anxious and much pinched and shrunk. The swelling in the right iliac fossa is very tender; he cannot bear the least pressure; on percussion there is dull resonance. He keeps his legs drawn up towards the abdomen in the recumbent position. Pulse weak, small, and slow. Tongue

clean, but dry. Has a fair appetite. Vomited once. Continued powders, enemata, and sleeping draught. Large warm bran poultices on abdomen, to be changed frequently. Spoon diet and two pints of milk; rum two ounces.

19th.—He had fever last evening, but it has passed off. Skin now cool and soft; pulse weak and slow. Did not sleep till towards the morning. Number and frequency of stools have again increased; had about thirty-five motions in the last twenty-four hours; some portions of yellow fæculent matter seen. Local pain and swelling continue as before. Omit ipecac. ℞. Gallic acid gr. vij., dil. sulph. acid ♏x., opii sed. ♏x., rum ʒij., decoct. koorchee ʒvj.; for one dose every three hours. Warm poultices. Diet, milk and sago; rum two ounces.

20th.—Slight fever again last evening; no sleep last night. Had thirty to thirty-five motions during the last twenty-four hours; some greenish-yellow, frothy fæculent matter is seen floating on a liquid of a light-drab colour, which, on being washed carefully, was found to contain small globular masses of gelatinoid mucus and a few jagged shreds of grey-coloured slough. No griping or straining; local pain and swelling continue, but the hardness is less; on percussion, the resonance is dull. He is getting weaker. Tongue red, dryish, but clean. Urine scanty, but voided without difficulty. Had no vomiting; no appetite. Continue medicines. Diet the same.

21st.—Had slight fever last evening. Bowels moved about twenty-three times during the last twenty-four hours, containing semi-liquid yellow-coloured and purulent matter, but without any blood. On washing, a dead round worm, some fragments of dark slough, and small masses of mucus were seen. Had some sleep, and took a little more nourishment than before, Pulse 88, but very small in volume; tongue red and dryish. Pain in the right iliac fossa and swelling diminished. Percussion elicits a clearer resonance. No griping or straining. Medicines and poultices continued. Diet same.

22nd.—Had about seventeen or eighteen stools in the last

twenty-four hours; motions again liquid, of a faintly yellow colour, and very fœtid. On being washed, they were found to contain a few black shreddy sloughs. No griping or straining, but is constantly moaning from pain in the right iliac region. Swelling and hardness much reduced in size, but on further pressure and light percussion an indistinct gurgling sensation is felt. Yesterday, at 4 p.m., patient was reported to have been slightly feverish; but at 5.30 p.m. the temperature was 98·8°. He is very low; speaking voice almost inaudible. Continued medicine. Diet the same.

23rd.—Had slight fever last evening. Bowels moved fifteen times since last report. Motions scanty, and consist of very putrid, chocolate-coloured, thick liquid, in which are seen suspended three or four small lumps of fæculent matter of a yellowish colour, enveloped in a coating of greyish mucus. The chocolate portion, on being mixed with water, became of a reddish colour, and at the bottom of the vessel some pieces of branny slough, as also a few small clots of blood, were seen; no gripings or strainings, but there is a general diffused pain in the right iliac hypogastric region, which increases on pressure. Countenance cadaveric; eyes and cheeks sunk; voice husky; tongue quite dry and red; pulse barely perceptible; skin dry, but colder than natural; has no hiccough, but has vomited; sleep disturbed. Takes almost no nourishment, and is very low. Continue medicine, soup, and rum. To relieve pain, some extract of belladonna and glycerine applied over the abdomen.

24th.—Is very low. Temperature last night was 97·6°. This morning the extremities are very cold; the weather has been chilly and wet, but he cannot bear to be covered. Pulse barely perceptible at wrist. Had twelve stools during the last twenty-four hours, which consisted of dark venous blood. On washing, the dejecta became light red in colour; at the bottom of the pan much dark blood-clot and shreds of black slough were seen. Tongue brown and dry; vomited twice; hiccough troublesome. Has passed a small quantity of urine with the stools. Pain and the peculiar doughy feeling in the

abdomen continue as before. Some diffusible stimulants were given during the day, and the night following.

He became low, and died at 4 a.m. next morning.

Post-mortem, four hours after death.—Body emaciated. No œdematous swelling of the limbs. No rigor mortis. Head not examined. Chest: Lungs apparently healthy and crepitant; no adhesion, no signs of hypostasis. Heart pale and flabby, otherwise apparently healthy. Abdomen: In the cavity of the abdomen signs of recent peritoneal inflammation were present. Here and there, soft and recently effused yellowish lymph was found covering the coils of the intestines. The lower portion of ileum and all the large intestines were of a dusky reddish colour outwardly. The sigmoid flexure of colon was drawn towards the lower part of the right iliac fossa, and was adherent, though not very firmly, to the lower portion of cæcum. Both the portions of the intestines were of a greyish-black colour, and on attempting to detach them from the right iliac fossa, the point of adhesion gave way, and their fœtid contents were extravasated. On removing the large intestines with a portion of the ileum, and laying open and washing them, it was found that no ulcerations existed in the ileum. The ileo-cæcal valve appeared to form a barrier to the progress of the ulcerative process upwards. But the whole of the cæcum, the lower portion of the ascending colon, its hepatic flexure, the lower portion of the descending colon, the whole of the sigmoid flexure, and the entire rectum, were a mass of ulceration and gangrene. The mucous membrane was entirely destroyed throughout, and the muscular coat presented a dark grey-coloured sodden surface. The lower portion of the sigmoid flexure at one side was a mass of jagged slough, black, charred, and very putrid, of about five or six inches long. The whole of the mucous membrane had sloughed away, and its subjacent muscular coat was seen projecting on an irregular and fungoid granulating surface between the excavations. In the transverse and descending portions of colon, the mucous membrane did not seem to participate so much in the morbid changes, but was of a grey and slaty colour. The portion of the

sigmoid flexure which was adherent to the cæcum was completely gangrenous throughout. Liver completely cirrhosed, much reduced in dimensions and weight. Its outer surface irregular and studded throughout with small hard prominences. Left lobe reduced to a very small size, and the right lobe of a globular form. The edge of the organ has become quite thin and membranous. The portal canals surrounded by thick, dense, and white bands of fibroid tissue. The structure of the gland coarse and pale. Capsule much thickened and dense, but on careful examination was separable from the gland structure. Some superficial veins ramifying on the surface of the liver were considerably dilated. Gall-bladder contained a very small quantity of thin and pale-coloured bile; its duct, and those of the liver, appeared pervious. Spleen considerably enlarged; its capsule thick and of a dense whitish colour; pulp very soft. Kidneys not examined.

Morbid Specimens (Dr. McConnell, Calcutta).

No. 1.—*Acute Dysentery.*

A Mahomedan, aged thirty, admitted into the Medical College Hospital, Calcutta, with acute dysentery of about ten days' duration.

The whole of the large intestine is affected. The mucous membrane presented a bright rosy-pink colour in the fresh state. The sub-mucous tissue is thickened, and the whole surface of the bowel is covered with innumerable small superficial ulcers, rounded or oval in shape, none larger than a two-anna piece, and almost all of them exhibiting a roughened and granular appearance, from recent yellowish fibrinous effusion over their surfaces and margins. The ulcers are extremely numerous in the descending colon, sigmoid flexure, and rectum, and this portion of the bowel is contracted in calibre. The thickened and vascular condition of the bowel extended from the cæcum into the ileum continuously for almost six inches.

The large intestine contained about an ounce of thin yellowish fluid, consisting almost entirely of shreddy mucus.

There are no notes of the progress or duration of this case, but it is not probable that death was caused by the mere lesion of the bowels. The patient must have succumbed to the general effects of the disease on his constitution.

No. 2.—Acute Dysentery.

A Hindoo, male, aged thirty; died on February 7th, 1880, on the eleventh day of an attack of acute dysentery. Medical College Hospital, Calcutta. Portion of the large intestine.

The mucous membrane presents a bright rosy-pink colour, more intense in parts, and is covered with numerous superficial serpiginous ulcers. These were most abundant in the cæcum and ascending colon, and again in the sigmoid flexure and rectum. The sub-mucous tissues are a good deal thickened. The patient was in a very broken-down state of health from secondary syphilis, and had recently undergone mercurial salivation. The stools were ten or twelve in the twenty-four hours, and contained an abundance of gelatinous mucus.

Here again the cause of death could not have been the bowel lesion.

No. 3.—Acute Sloughing or Catarrho-Fibrinous Dysentery.

Medical College Hospital.

A Mahomedan, aged forty. Admitted December 11th, 1879; died on December 15th. The disease was of fifteen days' duration on admission. He was greatly prostrated; severe griping pain all over abdomen, increased on defæcation. The stools, twelve to fourteen in twenty-four hours, consisting largely of blood, flaky mucus, and highly offensive putrilage; no fæculence. Large intestine examined. *The*

gut is diseased, from the cæcum to the anus it is swollen and rigid; all the coats greatly thickened. The mucous surface is covered with large, mostly transversely placed, sloughs or raw-looking ulcers. The latter have (in fresh state) vividly injected purplish and dark-pink margins; their bases are formed by the swollen, sodden-looking muscular coat. In the sigmoid flexure the ulcers are deep; their surfaces present secondary dark gangrenous-looking sloughing, while their margins are overlapped by recent granular rosy lymph.

No. 4.—Acute Fibrinous Dysentery.

Medical College Hospital.

A Hindoo male, aged thirty. Admitted July 13th, 1880; died July 16th, 1880. Dysentery of eight days' duration, according to his own statement. During life the stools were very numerous, contained much blood and blood-tinged flaky mucus, and latterly small bits of dark slough. The whole of the large intestine and adjacent six inches of the ileum preserved is covered by a granular exudation of lymph—the extension upwards of the disease in the large intestine. The mucous membrane of the latter, from cæcum to anus, is covered with tranversely placed sloughing ulcers; in addition to which there is, over the lower two-thirds of the gut, a copious exudation of yellowish-white recent lymph, which invests the margins of the ulcers, and even the surfaces of the sloughs which have separated. These ulcers are deep red and raw-looking. They reach to either the sub-mucous or muscular coat. In the rectum there are several loosely adherent sloughs, which present a very dark gangrenous appearance. The whole of the large intestine exhibits great rigidity and thickening of its walls.

This is a typical case of the worst form of dysentery, short of that in which the whole gut passes into a state of sphacelus.

No. 5.

A tubular slough, about nine inches in length, from the ascending colon of a native male patient, aged twenty-four, who died in the Medical College Hospital on January 21st, 1875, from dysentery combined with multiple abscess of the liver. This is an excellent illustration of the large size to which these sloughs may attain. It is not stated what its composition is—whether mucous membrane alone, or combined with sub-mucous, and perhaps some muscular, tissue; or if it be simply diphtheritic, and thrown off from the surface.

I am indebted to Professor Aitken, of Netley, for the following specimens from the Netley Museum. They illustrate some of the points to which I have alluded:—

1. Commencing contraction of rectum after dysentery.
2. Pin-hole perforation after dysentery.
3. *Contraction of Colon.*—Captain M., R.N., suffered from dysentery in China in 1857; died December 12th, 1876, after seven days' illness. Was a man of great activity up to date of last illness. Suffered from intestinal irritation and constipation. Death from heart and aortic disease; adhesion of colon immediately in front of spleen. Stricture admits a ball = 0·29″ diameter; colon distended above stricture; ulcer in caput cæc.
4. Numerous large abscess-cavities in liver; liver of large size, protruding high into thoracic cavity, and compressing lungs, and thrusting heart out of place towards left; after the discharge of pus, weight 14 lbs.
5. Exuviæ passed by stool.
6. Exudation dysenteric; gut commencing to thicken.
7. Dysenteric exudation.

In my next lecture I shall describe the treatment of the sub-acute and chronic form of dysentery.

LECTURE III.

Mr. President and Gentlemen,

I purpose to-day to consider the subject of chronic dysentery, the morbid changes in the abdominal viscera that accompany it, and the treatment, especially of those cases that are not unfrequently seen in this country as the result of disease contracted in India, China, or the tropics. Having disposed of this, I shall pass on to consider tropical diarrhœa, but chiefly that form of it which so frequently follows, and in many instances probably really is a form of, chronic dysentery; and to this I would particularly invite your attention, as it is so often met with among returned Indians and others, and is a form of disease which, though always serious, is, under favourable circumstances, more manageable and amenable to treatment than might be supposed. From the nature of the complaint, it is more frequently met with here than abroad, excepting in quite the earlier stages, for the reason that Europeans are generally recommended to quit the country where it began to affect them.

Much might be said, did time permit, in respect of the low forms of diarrhœa that occur in the ill-fed, malariously poisoned, anæmic natives, so often seen in some parts of India, in gaols and other localities, but especially of late years among the sufferers from starvation during famines.

The diseased conditions resulting therefrom have been the subject of special investigation recently by Dr. D. D. Cunningham, who made a most careful and exhaustive examination of the pathological changes that took place in

the intestines of the famine-stricken inhabitants of Southern India. I shall refer to his report, which not only throws much light on the special pathology of famine bowel-complaint, but has an important bearing on chronic diarrhœa generally.

In my last lecture I discussed the subject of acute dysentery and its treatment, the chief element of which is the use of ipecacuanha in large doses. I said little about any other remedy—except opium, which, even in the acute stages, is often urgently needed—for really none other are, as a rule, necessary. But, in the conditions of which I have now to speak, other remedies may be required, according to the state or stage of disease, and it is to these I now ask your attention.

First let me speak of the sub-acute condition, in which dysentery frequently occurs, and into which the acute form is liable to pass by recurrence of dysenteric action in the bowel, from any cause, after the first acute symptoms have passed away, or, as may happen, when it assumes this state from the outset, or, as it may be, after complete subsidence of the acute catarrhal condition, when there is supervention of ulceration in the glandular structures and in the mucous membrane of the bowel. By sub-acute I mean that variety where the symptoms indicate that some activity in the dysenteric process is present. There is pain, tormina, and tenesmus, though less than in the acute, and, when the disease has lasted some time, it is probable that ulceration, though not necessarily extensive, has taken place. In such cases ipecacuanha must again be resorted to, and probably the combination of bismuth, carbonate of soda, and quinine. The latter, if there be any malarial taint, is especially desirable.

When there is much pain on pressure on the abdomen, and the thickened gut can be felt on palpation, counter-irritation, over the part most affected, is likely to be of service. When there is much tenesmus, indicating rectal complication more than usually severe, opiate injections and large enemata of warm water are indicated; Dover's powder at night, and

injections of two grains solution of argent. nit. to the ounce of water.

As the sub-acute symptoms abate, and give place to those of a more chronic character, indicated by still frequent evacuations, with more or less straining and tenesmus, the discharges being mucous and occasionally tinged with blood, the internal use of twenty-drop doses of oil of turpentine, guarded by small doses (say ten minims) of tr. opii, every third or fourth hour, will be of service. Indeed, this is a remedy to which I attach much importance. I first became acquainted with its efficacy in Bermuda, in 1843, when I saw it administered with good results in the treatment of dysentery in the Royal Naval Hospital there, by Dr. G. King. Its value was so highly estimated that it had a reputation scarcely inferior to that now enjoyed by ipecacuanha. I believe it was subsequently found to be of service in the dysentery of China in the hospital-ship at Hong Kong, but of late years I have heard little or nothing of it; it has been superseded by ipecacuanha. In the stage of ulceration, I repeat, I have found it exceedingly useful. Its power of stimulating vascular action and of expediting the reparative processes is shown by its power of causing granulation in an indolent chronic ulcer, say on the leg. When given in fifteen to twenty-minim doses the effect is most remarkable; the surface becomes florid instead of dusky, red granulations form, and cicatrization rapidly results. I have no doubt it acts in a similar way in the ulceration of the bowel, and I have often been gratified with the rapid improvement that has attended its use.

Whilst any sign of activity in the dysenteric process continues, it is imperatively necessary that the strictest attention should be paid to diet, and that all solid or irritating articles of food should be carefully avoided. The use of alcoholic stimulants must be most carefully regulated, and, as a general rule, when there is no special reason arising out of former habits or great depression of the nervous system, it is better to avoid them entirely.

The greatest attention must be paid to clothing; flannel

should be worn next the person ; chills and sudden alterations of temperature most carefully avoided. All irregularities of living must be sedulously shunned.

Chronic dysentery is of more than one kind. There is that which follows, or rather is left by, an acute attack, when it has not yielded entirely to treatment, and the bowel has become structurally diseased—*i.e.*, ulcerated, thickened, congested—after the first urgent symptoms have passed away.

There is another variety, which never was acute from the beginning, or scarcely even sub-acute. It begins insidiously, and goes on so. It is truly chronic, may last for years, and then the two forms are somewhat alike, though in their origin they essentially differ. The chronic form that follows the acute is apt, indeed, to be more severe and to prove more frequently fatal than the other, which is more enduring, occasionally intermits, and though in the end perhaps fatal, is more slowly so. I have only recently seen a lady who suffers from this form of chronic dysentery, who first came under my care in India fourteen or sixteen years ago. Even then it was not the first attack. Though frequently ill and debilitated, this lady could not be said at any time to suffer from more than chronic dysentery, and, to say the least of it, her health is as good now as it was ten or twelve years ago. I know others who have suffered for years, and even go backwards and forwards to India. But what a precarious life! Such cases, no doubt, are familiar to many of you, for it seems to me that they are not very uncommon, and that a considerable share of the trouble to which old tropical or Indian residents are liable is due to this disease. They are very apt to be troubled with hæmorrhoids, either internal or external ; and it may be difficult to say how much of the symptoms is due to the hæmorrhoidal affection, or how much to chronic ulceration of the bowel higher up, or how far they may be attributed to contraction and stricture of the gut; such stenosis of the rectum being liable to induce attacks of tenesmus and the passage of mucous stools tinged with blood. The admixture of the mucous or sanguineous discharge *with*

fæculence points to rectal dysentery; whilst the blood and mucus *following* the discharge of fæcal matter indicates the hæmorrhoidal condition. In many cases it is exceedingly difficult to differentiate one from the other, nor indeed is that possible where the two conditions co-exist. Such cases are liable to frequent intermittent attacks of acute or sub-acute mischief, and cause great suffering; others, though not liable to recur with such violence, are brought on after the least exposure to chill, the disordered digestion and functional derangement of the liver and portal congestion accompanying that state render the subjects of them more or less chronic invalids. So long as the thickened and ulcerated state of the bowel continues, so long is the person liable to suffer from symptoms of chronic dysentery.

In the treatment of chronic dysentery a most essential element is removal from the place where the disease was contracted, if the patient can bear it. Not to the hills, where rarefied air and low temperature would be injurious; but change of climate is necessary. If in Bengal, for example, a sea-voyage to begin with, or, better still, a visit to Europe, where the patient should remain until the symptoms have been removed, and for some time after the action of the bowels has been restored to the normal state.

The pathological conditions of the bowel are interesting and various. There is either a continuous state of chronic ulceration in some part of the gut, which is thickened and indurated, or there is stricture from the cicatrix that has been formed, and it may be that the whole calibre of the intestine has been contracted until complete stenosis forms. In this state it is necessary that the patient be carefully watched, and symptoms treated as they arise, the closest attention being paid to his diet and in protecting him from vicissitudes of climate. Dover's powder, with bismuth and sod. carb., in five- or ten-grain doses, combined, especially if there be pain or tenesmus, should be given, with immediate recurrence to the larger doses of ipecacuanha if any symptoms of acute or sub-acute mischief recur. Sulphate of copper in quarter-grain doses, combined with half a grain of opium, in a pill;

or the turpentine (as before mentioned) in fifteen- and twenty-drop doses three times a day may be given.

Solutions of iron (especially if there be anæmia), quinine, and nux vomica have their advocates; and there are several remedies well known to the natives of India that have good effects. The bael (*Ægle marmelos*), the koorchee (*Wrightii anti-dysenterica*) in decoction, are often efficacious, and there are astringents that enjoy more or less repute.

Let me give a brief description of the cases in which the bael fruit is likely to be useful.

In the chronic condition of dysentery—in which the bowel is thickened, ulcerated, or indurated from cicatrization, and subject to recurrence of sub-acute action, indicated by straining and the discharge of mucus and blood, and the entire intestinal mucous membrane is sympathetically involved—the use of the fresh bael is likely to be of service; but it may be necessary to associate it with other remedies, such as opium or Dover's powder. From the power it possesses of giving tone to the alimentary canal generally, of improving the condition of the mucous membrane and its glandular apparatus, and of favouring cicatrization, it will not unfrequently aid in producing satisfactory results where other remedies, even turpentine, have failed. Vegetable and metallic astringents and tonics—such as kino, catechu, tannin, hæmatoxylin, eucalyptus, Wrightii anti-dysenterica, pomegranate, sulphate of copper, acetate of lead, alone or combined with opium,—may give temporary relief, but the disease continues to advance, the least error in diet, or alteration in temperature or hygrometric condition of the air, aggravating the symptoms. Such cases are not infrequent in this country; and no doubt the patients have taken the wisest and most effective step for restoration to health in coming home—one in comparison with which drugs are insignificant. In such cases the bael will sometimes materially aid in restoring the diseased intestine to its normal condition. Of course it will not alleviate all the morbid conditions that may arise in cases of chronic dysentery, and recurrence of acute symptoms may need more active treatment. But I think

you will sometimes find under its influence that the reparative changes in the large intestine progress quietly, until cicatrization is accomplished, thickening is removed, and, as far as may be, healthy action is restored.

Unhappily, many cases have not so favourable a termination, and the result is fatal, after long and severe suffering: the structural changes in the bowel are beyond repair, and the patient at last succumbs. In others the disease, though not fatal, is very tedious: a cicatrix may form, but the gut remains thickened, indurated, and contracted, its functions are imperfectly performed, and a condition of chronic disease and suffering remains; diarrhœa, sometimes dysentery, continues, and the patient is worn and wasted by continued suffering. The evacuations are light-coloured—grey, sometimes yellowish—often passed without pain or tenesmus, but at times accompanied by both, and mingled with blood and mucus. This ultimately undermines the strength, and the patient sinks from exhaustion. In the stages that lead to this state of things the bael is likely to be of service in retarding, if not in altogether checking, the mischief.

It is desirable that the bowels should be kept free from accumulations. This may be effected by small doses of castor oil or by saline laxatives; and one cannot too strongly insist on the necessity of obviating congestion of the hepatic and portal circulation. Enemata of tepid water or of congee-water (rice) to wash out and soothe the bowel, the use of opiate enemata at night to allay tenesmus and give rest, are useful; and in the rectal form of dysentery, as Dr. McLeod says, local medication with injection gr. ij. to ℥j. solution of nitrate of silver, of ergot gr. xij. in some starch, or five or six grains by the mouth, may prove very useful. The warm bath is sometimes beneficial, and all measures that insure rest or have a soothing action.

Where the bowel is thickened and tender on pressure, the application of a blister over the tender part, or of tincture of iodine—the counter-irritation being maintained for some time—may be useful; and, above all, the diet must be carefully regulated, consisting of mild, unstimulating food, solids only

being given with the greatest care. Rest and time, with the above measures carried out in a favourable climate, are likely to be successful. But whatever is done, time is essential. Where complications exist, they must be dealt with according to their nature. Hæmorrhoids must be prevented from causing hæmorrhage, and if they are painful or swollen must receive such local treatment as their condition suggests. Splenic enlargement with cachexia will require quinine and iron, or iron alone; hepatic enlargement demands such measures as are indicated by the nature of the enlargement. Should liver-abscess gradually supervene, it must be watched, the strength supported, and, if it seems practicable, the pus must be evacuated; and you will find, as shown in a case I shall relate, that liver-abscess is not always multiple when it occurs in combination with, or, as some think, in consequence of, dysentery.

In chronic dysentery of the scorbutic type, indicated by the spongy, bleeding state of the gums, and the general state of cachexia, perhaps associated with splenic mischief, preparations of iron, the solution of the pernitrate, iron and quinine citrate, potassic tartrate, or other easily assimilable form, with vegetables, lime-juice, and carefully-regulated diet, are needed; and in those cases where malarial poisoning has induced anæmia, splenic cachexia, and general atrophy of the tissues, including the mucous membrane and glandular structure of the intestine—a condition which is manifested by diarrhœa, a low adynamic type of disease, which is as much dysentery as diarrhœa, and forms, no doubt, a large proportion of the cases called tropical diarrhœa (of which more anon)—it may be that milk is the only food that will be assimilated, and the use of it the only treatment on which any reliance can be placed. Some of these cases of chronic dysentery recover under the influence of change of climate, careful dieting, absolute rest, attention to symptoms as they arise. Medicines, no doubt, are at times of great service, but recovery depends more on hygienic measures and proper food than on drugs.

Many patients linger for months or years, and succumb at last. The lesions in the bowel are never repaired. Not only

is the large intestine thickened or atrophied, ulcerated or contracted, but the small intestine also becomes atrophied and degenerate. The mucous membrane and its glands are wasted, the power of absorption is gradually lost, and the patient sinks from inanition and asthenia. The value of ipecacuanha in the treatment of this form of dysentery, when, years after the first attack, there is at any time a return of the acute symptoms, is great. By timely attention to this, much suffering may sometimes be spared, and a patient relieved, who otherwise might have drifted into a hopeless condition of chronic dysentery.

The question is often asked, in the case of persons suffering from chronic dysentery, where they had best live in this country? And I generally reply that they may live almost anywhere if there be a home, with its special comforts, good nursing, and dietetics; but when these are attainable anywhere, then to select some dry and not too much exposed locality, avoiding the vicinity of low or swampy ground,—to be on gravel rather than on clay. Avoid the east coast in the winter; select the milder air of the South of England—Hastings, Bournemouth, Torquay, etc. If the cold of the winter or spring be much felt, as it often is, go to the South of France or the Riviera. These, however, are refinements, and one can seldom say they are absolutely indispensable. The great change of coming to Europe is the most important one, and it matters comparatively little, when there, where the patient reside, if he be placed in a comfortable home, with all the advantages of nursing, feeding, and tending, such as only his own friends and relatives can give. The question will, sooner or later, arise as to the propriety of returning to India or other tropical abode, and the calls of service, of anticipated promotion, or of duty or business, and, above all, the *res angusta domi*, urge him to go sooner than may be expedient, though he may feel, or think he feels, quite well. It is often a difficult question to answer. And you have to decide between the result of disappointment, mental depression, anxiety, or the needs of the service, on one hand, and that of a certain still existing state of disease,

and the ultimate welfare of your patient, on the other. It becomes a question of the choice of evils—how much may a man risk; how much may you sanction? I advise you not to consent whilst any symptom of dysentery remains, nor until some time after the bowels have resumed their normal action, and all pain, tenderness, thickening, and irritability of the colon or rectum have passed away. There are cases where it may be necessary to give a modified assent, but if so, it must be coupled with the strictest caution as to the risks and the necessity for doing all that is possible to obviate them.

I have known men come and go between England and India, suffering from chronic dysentery, and recover at last; but I have more frequently known the contrary. It is our plain duty in advising, to make health the first consideration. If the patient be a free agent he must exercise his own discretion as to how he deals with your advice; but never leave him in doubt as to your opinion. I would again insist that the advantages of change of climate in this disease are inestimable, and, if combined with careful living, far outweigh all else.

Tropical Diarrhœa.

I pass on to the subject of diarrhœa, especially that form of it seen in old residents of India and tropical climates, in this country. It is to this I wish especially to ask your attention, for time will not permit me to dwell at length on other forms and phases of the disease.

Definition.—The definition that may be given of diarrhœa is—a discharge of fluid or semi-fluid excreta, serum, mucus, secretions, and the natural contents from the bowels. Though unattended, as a general rule, with tenesmus or much griping, there is increased peristaltic action and secretion, and hurrying on of fluid naturally secreted but not re-absorbed.

The causes are, irritation of various kinds—certain articles of food, drink, drugs, poisons, acrid secretions; mental emotions; sudden exposure to extreme heat or cold; morbid conditions of the mucous and follicular structures of the intes-

tines consequent on the continued operation of the above-named or other causes; diseases, such as typhoid, dysentery, cholera, hepatic disease, and others; miasmata of decomposing organic matter, alcohol, malarial poisoning, cachexia, or a state of general debility and tissue-degeneration of a fatty or lardaceous character, involving the intestinal tube with other tissues in general atrophy.

Etiology.—In considering the causes of tropical diarrhœa, we must refer to those already mentioned as giving rise to dysentery; for it is difficult to draw any line of differentiation between the diseases; and where official returns are obscure in this respect it may, no doubt, be ascribed to the uncertainty of diagnosis. So much is this the case, that, in the General Civil Returns, dysentery and diarrhœa are not separated.

Diarrhœa is a symptom of disease rather than a disease itself. It may depend on several causes:—

1st. On an effort to rid the intestine of offending ingesta, whether of food, drink, drugs, poisons, entozoa, acrid secretions, or the like.

2nd. On hepatic and splenic disease, or derangement of these functions and portal congestion; on structural change or functional disturbance in the abdominal viscera and mucous membrane and follicles of the intestines.

3rd. On a condition of general disease, when it is eliminative of morbific matter in the blood, as in septicæmia, renal disease, gout, fevers, dysentery, typhoid, cholera, tuberculosis, cancer, scurvy, anæmia.

4th. On the re-absorption into the blood of excretions and secretions, the suppression of natural discharges, when it is vicarious.

5th. On exposure to malarial and climatic influences, miasmata of various kinds, especially of decomposing fœtid organic matters, alcoholic intemperance, foul air and gases, sudden alternations of heat and cold, of dry or moist air.

6th. On mental emotions, such as fear, anxiety, anticipation, when it is reflex.

7th. And it may be the result of degeneration and atrophy

of the tissues generally, but of the bowel in particular, as a consequence of starvation or of malarial cachexia, when it is wasting and chronic.

A severe and dangerous form of diarrhœa is described as being due to the presence of bacteria (*mycosis intestinalis*) by von Recklinghausen, Waldeyer, Yeo, and others, in which violent diarrhœa and vomiting were rapidly followed by collapse and death, attended by the speedy development of this organism in the stomach and intestines, causing a catarrhal condition of the mucous membrane of those organs, congestion of the lungs, œdema of the areolar tissue of the mediastina, under the peritoneum, and of the intestines, with necrotic sloughs in the bowels, and infarction of the mesenteric glands due to embolism by those schyzo-mycetes—the disease and the consequent diarrhœa being a form of anthrax or malignant pustule in the intestines.

With respect to micro-organisms in dysentery and diarrhœa, Dr. McConnell writes to me, especially as regards dysentery: —"These are to be seen in abundance in most cases where the disease has advanced to the stage of sloughing or ulceration; not only in the substance of the sloughs before being detached, but also in the yet living mucous tissue in the neighbourhood of the sloughs, and at the margins and bases of the ulcers. This, however, is quite a different thing to attributing the disease, as some have lately done, to the presence of these organisms. On the contrary, I am inclined to believe that their presence denotes nothing more, probably, than that the parts affected are undergoing devitalization, and that just as in gangrene, erysipelas, extravasation of urine, etc., micro-organisms are to be found in abundance in the tissues becoming destroyed, so in dysentery, their presence is merely indicative of the same or a similar change, and has nothing specific in it."

I remember a severe outbreak of diarrhœa among some Greek families in Calcutta that occurred several years ago, and which was traced to an acarus infecting some new dry caviare, recently imported from Novgorod. It had not been observed before by these gentlemen, in an article of diet

with which they are familiar, and they were much impressed when shown the insect under the microscope. It was suggested that the symptoms might have been due to a poisonous fungoid growth, some microphyte, but none could be found. The diarrhœa ceased when the caviare containing the acarus was discontinued.

Having regard to these causes, a certain classification of the disease, which answers well enough for practical purposes, may be stated in the following terms:—

Fæculent diarrhœa, the result of the presence of certain irritating matters in the *primæ viæ*, removed with removal of the cause.

Congestive or inflammatory, due to continuance of irritation, or catarrhal conditions thereby induced, or to constitutional causes.

Checked action of skin, or miasmata, when the mucous surface, villi, and follicles of the intestine may be implicated. There may be inflammation or even ulceration, and serous, mucous, or fibrinous and flaky discharges mixed with the fæcal matter, accompanied by pain, griping, and even blood; apt to pass into dysentery, perhaps *is* dysentery from the commencement. Though, like the ordinary acute dysentery, these cases are generally amenable to early treatment, they may pass into a chronic stage. In India or the tropics they so closely resemble dysentery, if they are not identical with it, that they may be called either dysentery or diarrhœa.

Then there is the bilious diarrhœa, the autumnal or summer diarrhœa, the so-called sporadic cholera, which sets in with great violence in India, and may so exhaust the patient by the loss of serum which accompanies or follows the expulsion of the ingesta, and bilious and other secretions, that symptoms of collapse, and the other conditions peculiar to true cholera, such as cramp, suppression of urine, great thirst, may occur. It may occur in this country, and often causes great debility. The conditions are indeed very like, if not identical with, those of true cholera. Of course, I do not say the causes are identical, for I confess I am ignorant of the

precise nature of either; but the appearance of true cholera is frequently heralded by cases of this kind; and it is often a great source of anxiety in India, when such an attack of diarrhœa does make its appearance, lest it should pass into real cholera.

Happily, if it has not this tendency, it is readily controlled; but those who have been in cholera camps and regions, and have had to deal with outbreaks of cholera, know the vital importance of checking looseness by some sedative and astringent at the outset, feeling well assured that by so doing they may in many cases prevent the sufferer from passing into the dangerous condition that is foreshadowed by the diarrhœa.

Doubtless, in many cases astringent and sedative remedies are given, when a dose of castor oil or Gregory's powder would have been more to the purpose, but that is an error easily rectified; whereas the passing of a diarrhœa into cholera is a very serious matter, and may prove fatal if not checked at the outset.

Lastly, there is the chronic diarrhœa, depending on visceral changes due to constitutional causes and defective nutrition. As to the nature of the diarrhœa that prevails in India and the tropics, I may say generally that all the forms of diarrhœa observable in Europe may be seen there, and are amenable to the same methods of treatment, which have for their object the removal of peccant matters, the allaying of irritation and congestion or inflammation, and the treatment of the constitutional conditions that may be the cause of the evil.

Europeans and natives suffer in India from indiscretion or intemperance in food and drink, and from changes of temperature, etc.—in short, from whatever causes the disease elsewhere; and in some instances, no doubt, these are intensified by climatic conditions. It is of diarrhœa due to tropical and malarious influences—that which results from the consequent debility and cachexia induced by these conditions—that I wish to speak.

In my first lecture I said that diarrhœa is the cause of considerable mortality in India, both among Europeans and

natives, the following being the prevalence or death-rates :—

Of different classes.	Strength.	Admitted.	Died.
European Army	56,475	3,972	4
,, women	5,170	299	8
,, children	10,423	1,033	149
Native Army	117,272	4,747	112
Gaol population	127,914	12,998	1,865
Civil population	2¼ per 1,000, among 182 millions of people, of diarrhœa and dysentery.		

I told you, also, that there was some uncertainty as to the precise nature of the cases appearing under the different headings in the returns, especially as regards the civil population, where it is impossible to have the same accuracy of registration as in the army or gaols, considering the immensity of the population and the comparatively small means of carrying it out ; and that in the returns, dysentery and diarrhœa are classed together under one head, "Bowel-Complaints" ; still, the information we derive from them, and from experience, shows that diarrhœa is frequent and sometimes fatal, its prevalence and fatality being closely related to climatic and local causes, whilst defective food, impure water, and insanitary conditions of living, are largely concerned in producing it. Many cases, were it possible to trace their history and termination, might be transferred to the columns of cholera or dysentery ; whilst a large proportion, in some years at least, would be traced either to the direct or secondary effects of famine, which cause degeneration of the intestine and digestive organs ; and these results are not only to be seen in the immediate area where the famine prevailed, but in remoter districts, where the people have suffered slow starvation, from the diminution of their natural food supplies, caused by the exportation of grain to meet the wants in the actual famine districts. The subject has been most carefully investigated in all its aspects, and reported on, by medical and other officers ; whilst the nature of the pathological processes set up by chronic starvation, especially in reference to the resulting bowel-complaint, dysentery, and

diarrhœa, for you may call it either, as the diseases are often nearly allied to each other, has been exhaustively examined by Dr. D. D. Cuningham, who has given a most valuable account of the pathological changes of a fatty or lardaceous and atrophic nature that occur in the mucous surfaces and follicles of the *primæ viæ*, as well as in the tissues generally; and which show not only the effects of complete starvation, but that a process of chronic starvation and inanition, caused by insufficient food, induces degenerative changes in the intestines that render them unfit for the functions of nutrition; and that the mortality induced by these secondary causes is necessarily great. The lesson to be derived from this is the importance of providing the population with sufficient food to prevent the tissue-changes that in chronic starvation are inevitable, and which in the end prove so fatal.

The mortality, indeed, has been great, and a considerable portion of it was due to bowel-complaint. This, to a certain extent, may be regarded as an exceptional cause of diarrhœa, but the experience it affords suggests the following considerations:—First, how to prevent these degenerative changes in the intestines; second, how far they may proceed without proving fatal; third, what can be done to assist nature in repairing the mischief when it has occurred?

Though it is not diarrhœa caused by famine that I propose to describe, yet in many cases it is as nearly as possible the same disease; for though the patient may not have been famished into a state of fatty or lardaceous degeneration of his stomach and intestines, yet, if he have been brought into that condition by climatic or other causes, he is practically as much starved as though he had been in an Orissa, Bengal, or Madras famine; and he is in as much danger of dying from inanition, because his intestines have lost, from the same form of degeneration, the power of performing their natural functions. Such, indeed, is the condition of many of the cases of chronic diarrhœa in old Indians and other tropical residents that come under our observation here.

Chronic diarrhœa, diarrhœa alba or white flux, is one of the most important, as it is a most dangerous, form of

the disease. All diarrhœas may become chronic, and when they do so, induce exhaustion, anæmia, and ultimately tissue-degeneration; but it is in the peculiar form to which I now allude that the worst symptoms are manifested, and that a dangerous and protracted state of disease results. It is insidious and slow in its progress, but surely wasting in its effects; and when protracted beyond a certain stage, it is fatal, owing to the irreparable state of degeneration of the intestinal mucous surface and glands, and the consequent inability to absorb nourishment. Death results from slow inanition, simply because the channels for the admission of nutritive material are destroyed.

This form of diarrhœa has been described by Annesley, Twining, Martin, Goodeve, and others, especially by Mr. A. Grant, in the *Indian Annals of Medicine*, in one of the most interesting of many important papers on tropical disease published in that valuable journal. It is commonly known in India as "hill-diarrhœa," because it is apt to appear in some of the Bengal hill-stations, where malaria, atmospheric changes, and very probably water, are instrumental in producing it in persons who have suffered more or less from the debilitating influences of the plains, though by no means confined to them, for it occurs sometimes to recent arrivals, and to those who do not seem to have suffered otherwise from the effects of climate; still it must be regarded, I think, as a climatic disease.

The hill-diarrhœa and the white flux of other parts of India are only modifications of the same disease, and in their pathology and symptoms so much alike that I regard them as identical. It is frequently seen in this country, perhaps as often as in India, for it is so well understood that removal from the climate or site where it was contracted is necessary, that those who suffer from it are generally sent home. There is, as I before remarked, a close resemblance of this disease with some forms of chronic dysentery.

Sir R. Martin has well said—"Although chronic diarrhœa generally follows on previous tropical disease, I have seen it affect persons on their return to England, who,

during their residence in India, had never suffered from any of the diseases of that country. The health of such patients, however, had been enfeebled, and they were thus rendered susceptible to the influence of cold or damp, or, what is always more injurious to the returned Indian, to both conjoined. The returning Indian is often seized with diarrhœa from exposure to cold on board ship, especially if exposed to the spring easterly winds. The cold of the English winter and spring proves very adverse to the cure of this disease, and I have constantly to send patients suffering from it to the sheltered places on the coast, as Hastings, Bournemouth, Ventnor. Fatigue is almost as injurious as cold. An officer sent to Bournemouth walked beyond his powers. The result was a relapse that nearly proved fatal."

I may add that persons who come home from India suffering from general debility, from climatic cachexia, "too long in India," attended with hepatic derangement, and a congested portal system, are liable to be troubled with diarrhœa of an irregular character, generally most troublesome in the mornings, rendering the patient unable to go out or undertake anything before eleven or twelve o'clock—or after taking food, or from fatigue of any kind, or any indiscretion in diet or drink, or exposure to cold or damp. Such are benefited from relieving the congested portal system by the aid of saline laxatives, careful well-regulated diet, attention to clothing, and, above all, by the good effects of change of climate. These cases are sometimes obstinate enough, most so in those who have had long residence in India, and especially if there be any hepatic or splenic complication, or any vestige of former dysentery. They, however, are not of so grave a nature as the chronic white tropical diarrhœa, and recover more quickly, betokening rather functional disorder and congestion than structural and degenerative changes in the viscera and the mucous surface of the bowels. There may, of course, be some atrophic change, but this will soon be made out by the character of the excreta and the general progress of the symptoms.

I pass over other forms of diarrhœa with the mere mention that I have made of them, as subjects on which I could have little to say that would interest you.

Let me now say a few words on the symptomatology of this special form of chronic diarrhœa, for it expresses all of general importance regarding tropical chronic diarrhœa.

Symptomatology.—This is one of the most troublesome, tedious, and often dangerous forms of diarrhœa, often intractable and obstinate in character as it is exhausting in its effects. Though generally seen in those who have spent many years in hot climates, it occasionally occurs in others who have been there but a short time, and is known as "diarrhœa alba," or white flux—so called from the grey, whitish, light, or clay-coloured evacuations, which are frequent, copious, fluid, or semi-fluid, often frothy, and occasionally lienteric, especially after any indiscretion in diet; or mixed with mucus tinged with blood, when any fresh source of enteric irritation or congestion may have occurred..

Its origin is often insidious, commencing with simple looseness of the bowels, little or no pain, and producing rather a feeling of relief than of suffering; and not until the subject of it finds he is losing flesh, strength, and energy, does he realize the serious nature of the complaint. It seems to be the result of climatic influences in which, probably, malaria is concerned, and is due rather to a general derangement of the hepatic, splenic, and gastro-intestinal functions and to atrophy of the mucous membrane, its villi and glands, than to the usual irritant or eliminative causes of diarrhœa.

The appearance of the dejections is suggestive of deficient or altered bile; but this probably may be accounted for by the general state of anæmia rather than by any actual disease of the liver itself. It is only as the disease progresses that the pale colour of the excretions becomes so marked, for in the outset they resemble those of ordinary diarrhœa. The balance between exhalation and absorption seems to be disturbed, and much of the fluid which, in the natural osmotic circulation of intestinal fluids, would be re-absorbed, is hurried on and

expelled; the absorption of nutrient matter is interfered with, and wasting and degeneration result, as may be seen in the attenuated and exhausted frames and atrophied bowels of those who have died from the disease.

The appearance of persons suffering from this disease is characteristic. They are pale and emaciated, with loose, dry, flaccid, flabby skin, which in later stages becomes discoloured as by chloasma or Addison's disease. The fat disappears; the eyes are pearly; the lips and conjunctivæ are blanched; the tongue is dry and smooth, and in advanced stages it appears contracted and shrunk, its papillæ are obliterated, the surface is red, glazed, and dry, at times its edges are excoriated, and the buccal mucous membrane, the seat of aphthous spots or epithelial proliferation, and so tender and sensitive as to be intolerant of wine or any substance or fluid in the least pungent or stimulating.

The earlier phases are often characterized by some evidence of malarious poisoning, such as fever, neuralgia, or myalgia. Distension of the abdomen, especially after food; dyspepsia; irritability of the bowels, which are provoked by anything taken into the stomach to expel their contents; general languor and debility, mental and physical, increase, until all exertion is difficult and distasteful. As the diarrhœa gradually increases, these symptoms may, to a certain extent, be mitigated, and the patient think himself better; but as it insidiously progresses, the strength fails, and sooner or later he finds himself compelled to give up work and seek recovery in change of climate. There is at last extreme anæmia; dropsical effusions take place into the areolar tissue of the lower extremities.

A very similar, perhaps identical, form of disease is known in some of the hill-stations of India as "hill-diarrhœa," and has been well described by Twining, A. Grant, E. Goodeve, and other Indian medical officers. It often proves intractable, and even fatal. Occasionally, perhaps, it is the result of injudicious selection of climate after recovery from disease. Many of the cases trace their origin to a hill-station in India, where the sufferer had gone in search of health which he

was more likely to have recovered by a sea-voyage or a visit to Europe.

This chronic white diarrhœa appears to be as much the result of general degeneration of all, as a special disease of certain organs. Anæmia, the result of inanition, imperfect absorption, and waste of the nutrient material, is the most marked symptom during life. Examination of the bodies of those who have succumbed to the disease shows that the wasting which is so marked in the body generally, has extended to the viscera themselves. When death has occurred at an early period, from the intercurrence of other disease, the intestines are found contracted, with the mucous lining thickened and congested, even ulcerated; but when death has occurred later, the coats of the bowel are found to be attenuated and diaphanous, the seat of fatty or lardaceous degeneration, frequently ulceration in both ileum and colon, the glandular structures and the mesenteric glands atrophied and degenerated, the mesentery itself wasted. The liver is shrunken, pale, and contracted; the spleen and kidneys often in a similar condition. There may be, in certain instances, enlargement of liver and spleen; but in ordinary cases of the disease there is no such complication.

Though chronic diarrhœa is frequently the result of general degeneration of health from malarious cachexia, it is not always so, and other sources of enteric irritation or of elimination, caused by disease or disordered condition of the liver, spleen, or kidneys, or chronic dysentery, may give rise to it; but it is the simpler, though not less serious, form that I now speak of, and for the management of which I shall presently offer a few suggestions.

Pathology and Morbid Anatomy.—The opportunities of studying the morbid changes that take place in ordinary examples of the disease are not frequent, as in so many cases where death occurs it is under circumstances where post-mortem examinations are not readily obtained; the invalids who succumb being frequently persons who die in their own homes, and when there is seldom opportunity of obtaining permission to make an autopsy. In some cases, however,

as in hospitals, infirmaries, etc., it does happen that an investigation can be made, and I will describe the pathological changes that generally may be observed.

It has long been known that the disease is associated with chronic disease of the liver. Annesley, Twining, and others have described it. Martin, Grant, Goodeve, and others have pointed out its connexion with visceral disease and wasting of the tissues, with general anæmia; whilst post-mortem examinations have demonstrated the attenuated, blanched, and atrophied state of the mucous membrane and follicles of the intestines. E. Goodeve gave an account of the state of the mucous membrane and glands, showing that in some cases they were in a state of amyloid degeneration; this I also pointed out in a paper written three or four years ago. He says that "in children dying of the inflammatory form of diarrhœa there may be some swelling of the follicles and Peyer's patches, but in the chronic forms there may not be much surface-change, except in the inflammatory varieties. There may be traces of redness in patches, ulceration of the glandular structures in various states of repair, greyness of portions of the mucous membrane, black or dark margins to the ulcerated tissues or healed ulcers, and puckering and contraction. In some chronic diarrhœas, especially those with the white flux, in spite of the long duration of the disease, little or no change of the mucous surface is to be found. There is great thinning of all the coats of the small intestines, so that they are quite translucent, and there is doubtless atrophy of the glandular tissues." "When these patients have had dysenteric symptoms towards the close of life, ulceration or sloughing of portions of the colon may be found. The mesenteric glands are generally enlarged and hardened in chronic diarrhœas, but especially in the white flux. The liver is not necessarily altered, even in the white diarrhœa; but it has been found flaccid, anæmic, and small or of natural size, but without any decided morbid appearance. It occasionally presents patches of fatty degeneration, but this is not peculiar to diarrhœa."—(Article, "Diarrhœa," in "Reynolds' System of Medicine," vol. i., pp. 96, 97.)

In regard to the question of amyloid or lardaceous degeneration, Dr. McConnell, of Calcutta, who has many opportunities of investigating pathological questions of this nature, and who occupies with great credit the chair of Pathology in the Medical School of Calcutta, in reply to a question put by me to him on this subject, writes: —"Amyloid degeneration of the bowel, as far as my experience goes, is very rare among the natives of this country. I do between 200 and 300 post-mortems here yearly, and I think I find about one in 100 cases of amyloid degeneration of *any* organ or organs of the body. I really do not think it is commoner than that, and of all parts the intestines are least frequently affected." He recognizes the accuracy of the account given by Dr. D. D. Cuningham of the morbid anatomy and structure of the intestines of the sufferers from diarrhœa and dysentery in the Indian famines—a condition probably similar to that of other chronic diarrhœas.

We are much indebted to Professor Aitken for the very definite and clear account he has given of lardaceous degeneration in the intestines in certain forms of diarrhœa. He says:—"Lardaceous disease of the intestines comes next in frequency to that of liver, spleen, and kidney," and "involves the arterial capillaries of the villi and surrounding networks of mucous and sub-mucous tissues, it progressively involves the villi, mucous, and sub-mucous capillaries, infiltration around the solitary glands, and degeneration of the vessels surrounding the Peyer's glands."

He has repeatedly met with it, in the cases of soldiers at Netley, where it involved the whole tract from mouth to anus. Anæmia of the mucous membrane, with a peculiar glistening or shining aspect of its surface, are the most characteristic signs of the lesion, "otherwise there are no outward signs to attract attention." The application of the iodine test is necessary to detect it.

Aitken refers to Virchow's account of this condition, and says: "Virchow has known the villi to drop off, and the intestine to be bare of villi." Such, I believe, would not unfrequently be found the case when death has resulted from

advanced stages of chronic diarrhœa. "Sometimes the villi are changed into lardaceous or albuminoid material."

Ulcers form; Peyer's patches and solitary glands are enlarged at one time; ultimately they are destroyed by a "granulo-fatty disintegration." The whole tissues, in fact, become degenerate.

Dr. Grainger Stewart has said that "hæmorrhage from the bowels or stomach may occur in the secondary stage of this condition. There is neither colic nor pain, and the hæmorrhage may occur independently of any ulceration of the mucous membrane, but as there is so frequently ulceration it may be the cause when hæmorrhage does occur." The tropical diarrhœa with which I am immediately concerned no doubt partakes largely, in the character of its intestinal lesions, with the morbid degeneration so elaborately described by the above-named authorities.

But I would refer you to the very elaborate and careful examination in the Report by Dr. D. D. Cuningham * on the diarrhœa and dysentery in the famine districts, in which he shows how the degenerative and structural changes involve the intestine and other viscera. And it is impossible, I think, not to see the bearing of those observations on the pathology and therapeutics of chronic bowel-complaint generally, whether it be dysentery or diarrhœa.

The following is an abstract of the observations made in this valuable Report:—

The mucous membrane of stomach, jejunum, and duodenum was white, pulpy, soft, and bloodless; some traces of congestion, marks of disintegration, in jejunum; disappearance of epithelial coat; pigmentation and atrophy of sub-epithelial areolar tissue. Mucous membrane of ileum presented more evident signs of change; bloodless generally, but here and there patches of congestion; epithelial coat disorganized or absent, and sub-epithelial tissues affected. Solitary glands either very few or almost entirely absent. Peyer's patches were an empty network of elevations, sur-

* Fourteenth Annual Report of the Sanitary Commissioner with the Government of India, 1877.

rounded by slightly elevated ridges; the adenoid tissue virtually absent; surface smooth; villi almost unrecognizable. Muscular coat, covered only by a thin membranous investment, seemed to form the inner lining of the tube; most pronounced over lower half or two-thirds of ileum.

Microscopical examination showed that the epithelium, where present, contained much fat, the cells including large quantities of oil granules. In the vicinity of denuded areas, vestiges of cells and free granular matter present. The sub-epithelial tissue showed evidence of similar changes; the nuclei granular and oily. This may, to some extent, have caused the appearance of pigmentation that was observed, but there was a certain proportion of pigment granules.

It is impossible to say whether this deposit of pigment in the mucous membrane is essentially connected with the morbid processes. It is a phenomenon of other wasting diseases, and is generally ascribed to antecedent minute extravasations of blood, but it *may* be due to degenerative processes. In the more advanced stages of atrophy of the mucous membrane the nuclear elements in the villi appeared to be almost entirely absent, and the villi were represented by abortive processes containing granular matter.

The mucous membrane of the large intestine was also generally anæmic—white, but mottled pink here and there, and its texture very soft. In some cases there was thickening. Besides the general softening there was evidence of loss of substance in some places. These patches in certain instances might be called ulcers, in others they seemed to be merely the result of disintegration and atrophy. In such instances there was no evidence of congestion, and the colic lymphatic glands were pale and inconspicuous. The appearances presented by the mucous membrane were sometimes more like those of dysentery. In one case this was decidedly so. There was great thickening of the gut, the mucous membrane was broken up into hard rough masses of purple and green colour, distinct ulceration had occurred,

and there was considerable congestion, whilst the lymphatic glands were turgid and deep-purple-coloured.

Fatal cases of the so-called famine dysentery may occur in which no true dysenteric processes, as ordinarily understood, are present. The essential process appears to be the same as that affecting the small intestines, but it may be complicated in various degrees by the supervention of true dysenteric changes. Does it not show how nearly the two diseases are allied—perhaps only different manifestations of the same? The liver was small, pale, yellowish, fatty-looking; in some the cells were healthy, in others full of fat granules. Gall-bladder half full of bile; it was healthy in those where the cells were healthy; in the fatty it was pale, yellow, and very thick. The spleen was small and firm, in most cases conspicuously so. In some cases it appeared to present little save a dense contracted mass of stroma, in a white shrivelled capsule. Kidneys, as a rule, pale and anæmic; in some fatty degeneration of the epithelium. Pancreas, normal in some; in others, substance seemed as though it were opened out, the lobules widely separated. Brain slightly anæmic. The general result of the entire series of observations was to show that the diseased conditions were specially characterized by extreme general anæmia and destructive processes affecting the mucous membrane of the intestinal canal.

A word or two on the diagnosis between dysentery and diarrhœa, which is often difficult. Diarrhœas are generally free from mucus and straining in the early stages. In chronic dysentery there is blood and mucus more frequently than in diarrhœa, though where there is ulceration in diarrhœa there may be blood, and it is difficult to determine which to call it. It is, after all, not a matter of much practical importance; and, as I have already said, the conditions are so similar that they are often confounded. In the earlier stages there is no difficulty; in the later the treatment of both is much the same.

I have just received a paper on a form of chronic diarrhœa, by Dr. P. Manson, known in China and in Java by the name

of Sprue; it appears to be the same disease as that I have been describing, or a variety of it. He describes it as a result of inflammation of the alimentary mucous membrane, with anæmia and general atrophy; and ascribes it to the influences of a tropical climate on the European constitution, especially after long residence in the East. This, like all Dr. Manson's writings, is an interesting and valuable contribution on the subject of which it treats.

Treatment.—I shall confine what I have to say on the subject of treatment, to that of chronic diarrhœa; for it is needless that I should occupy your time by describing that of the ordinary forms. I would merely again refer to the importance of checking all forms of diarrhœa during cholera seasons, or when that disease is imminent.

The commencement of chronic diarrhœa is often insidious, and the disease gains ground before radical measures are resorted to for its removal. In the cases that come under notice at home, the most essential step towards recovery has been taken by returning to Europe; but there remains much to be done to further the improvement, which has probably advanced considerably during the sea-voyage.

The successful treatment of chronic diarrhœa depends very much on the patient's resolution and perseverance in carrying out the instructions he receives. Diet is the most important element in it, and this must be strictly regulated; all irritating or indigestible and solid food must be at first entirely prohibited, and only that which is most easily assimilated allowed. Milk, alone or diluted with about one-fourth or one-third part of lime-water, given in small quantities and at frequent intervals, say a wineglassful or small tumblerful every second or third hour, in some cases more frequently, will generally be found to answer, and may be continued for a long time, to the exclusion of all other food, with great advantage. Milk undiluted will not always agree, as may be seen by its causing irritation, frequency of action, and the passage of undigested caseine; but it is quite sufficient for all purposes of nutrition, and by the time the patient finds that he is taking three to four quarts a day, he

will have realized that he obtains from it all that is needed to support health and strength. At first he may lose weight, but soon regains and increases it. Beef-tea, raw beef-juice, or other plain animal broth, free from extraneous matters; a raw egg beaten up with milk, to which a teaspoonful of brandy may be added, will sometimes be tolerated; arrow-root, tapioca, or other plain farinaceous food will sometimes, but not always, answer—certainly not at first. Tea and coffee, as a general rule, disagree, and should be avoided. Stimulants, especially for those who have long been habituated to their use, may be needed; the best are a little whisky or brandy diluted with Vals or Vichy or potash water; but these should be laid aside if they increase the action of the bowels. A little good port wine may be tried; but, as a general rule, I find all wines unsuitable. Regularity in the times of administration and in the quantity of nourishment given is most essential. The greatest care should be taken not to give too much of anything at a time, and at once to discontinue whatever appears to disagree.

It is necessary that the patient should be kept warm, and at an equable temperature day and night. The body should be covered with flannel or woollen next the skin, and a flannel bandage should surround the abdomen. Chills and damp are especially to be avoided, for exposure to them may seriously aggravate the mischief. During cold weather the patient should not leave the house.

As the condition improves, this discipline may be relaxed, and gradually the patient may be allowed to go out and take moderate exercise; but until considerable improvement has taken place he should be extremely careful in this respect. It is desirable to keep much in the recumbent posture, as mechanical rest for the bowels is a most important element in the treatment. It might be well, if possible, for the patient to reside during the cold months of the year in some of the milder and more sheltered parts of the country, and perhaps near the seaside of the south coast. The care, attention, comforts, and good food of a home, however, are more important than any benefit to be gained from such changes

as may be derived from removal to different localities in the United Kingdom, where home advantages *might* be wanting. As the diarrhœa diminishes, the condition of the excreta improves, and strength is regained, the diet may be more varied, and out-of-door exercise more freely taken. But long after recovery is apparently complete, the greatest care must be taken to avoid errors in diet, over-fatigue, or exposure to extremes of temperature, or a relapse may take place. It is desirable that the stay in Europe should be prolonged, especially after recovery from severe attacks, beyond one Indian hot season at least, and it may be necessary to defer return to India for another year.

Drugs will do little good if strict dietetic and hygienic rules are not most carefully and continuously observed. Under the impression—derived chiefly from the appearance of the evacuations—that the liver is mainly at fault, it is sometimes deemed expedient to administer cholagogues or alteratives. This, I think, is unnecessary, as there is not sufficient ground for supposing that the liver is specially at fault. The chief indication is to restore the healthy functions of the bowel by giving it rest, to promote absorption, and delay the expulsion of its contents. This we may hope to effect by introducing only bland, unirritating, and nutrient fluids, by allaying irritation and checking excited action, and by administering such remedies as may tend to improve the general health.

To allay the irritable state of the bowels, the compound ipecacuanha powder, in combination with bismuth, quinine, and alkalies, may prove useful; where the motions are fluid, copious, and frequent, tannin or gallic acid may be given in combination with Dover's powder. Sulphate of copper with opium has been recommended. Dilute nitric and muriatic acids in combination with opium have been found beneficial where other remedies have failed. Nitrate of silver is sometimes given, but I have not found it to produce very satisfactory results.

Counter-irritation over the abdomen by sinapisms or turpentine stupes is useful. Opiate and small demulcent

injections are often efficacious in allaying the irritability of the bowel and giving rest; hypodermic injection of morphia may be tried, if opiates do not agree, but I have not found it necessary to resort to them. Opiates are sometimes objected to on account of their interference with the secretions; but this is, I believe, a groundless objection. The colour of the evacuations need not prevent their use, and the rest and quiet they give may be of importance. Mucilaginous decoctions or infusions, such as those prepared from the fresh bael fruit, or from the issofgool (*Plantago Isphagoola*), the seeds of which are often given with good effect by the natives of India for the sake of the mucilaginous envelope, solution of gum, water arrowroot, etc., may be beneficial for their soothing and nutrient properties.

The preparations of iron are often useful in controlling the diarrhœa and in improving the condition of the blood. The iron alum, in doses of four or five grains, the citrate or the potas. tart. of iron, in three to five-grain doses, in some aromatic water, two or three times a day, are good forms in which it may be given; and it may, viewing the malarious origin of so many of the cases, be well to combine quinine with the iron. Two or three grains of quinine with three or four of Dover's powder, and three or four of bismuth, may be given. In the earlier stages of the disease, where there is hepatic and portal congestion, ipecacuanha in large doses—ten to twenty grains—may cut short the state which would have passed into diarrhœa. This, however, is quite inapplicable to the disease in its more developed stages. I have found some cases which were aggravated by a state of portal congestion, improve rapidly after a few doses of a saline aperient.

As recovery progresses, preparations of quinine, iron, and other tonics are beneficial. A visit to some of the Continental health-resorts may be of advantage in expediting recovery, not only for the sake of the waters, chalybeate or others, but for that important element in recovery from nearly all chronic diseases, "change," and for the regulated and physiologically correct life, and the mental tone, imparted by the determination to get well.

The use of drugs will be modified by the peculiar circumstances of each case, but I think that, generally, the plan I have suggested will prove successful in cases that have not advanced too far. Where emaciation has made great progress, where the tongue is always red, smooth, and glazed, the mouth dry or aphthous, the diarrhœa constant, and the exhaustion great, one cannot but feel great anxiety and uncertainty as to the result, though it is seldom necessary to declare a case hopeless. The diarrhœa may disappear in this condition, giving a delusive appearance of improvement, which is not unfrequently the precursor of death. Happily, a number of chronic diarrhœa cases of the character I have been describing have a favourable termination, and they are so in proportion to the care in which the patient adheres to the plan of treatment laid down for him; and I would emphatically repeat that strict adherence to simple milk for a long period—it may be for months—will often prove of more value than medication of any kind.

I would only add, in conclusion, that in these cases the fresh bael, taken early in the morning in the form of mixture, or sherbet, as it is given in India, will often have good effect. A remedy that has often produced good results in India could hardly fail to do so here; but of course it, like all other mere drugs, is altogether of secondary importance to the dietetic and hygienic measures I have tried to describe.

I will now relate the details of some cases illustrative of the diseases I have just been considering.

Case 1.—Chronic Dysentery.

C. H., aged thirty; December 7th, 1880. Has been at Manilla since 1872, though away at times. Had dysentery and fever after six years of health. Returned to England in 1879. Went out again in 1880, but had to leave in three weeks, with return of dysentery and diarrhœa. He is pallid, anæmic, and emaciated. Passes blood and mucus, and loose

fæculence. Tongue clean, not smooth. Bowel thickened. Functions otherwise healthy. Argent. nit. injection gr. ij. ad ℥j. Ipecac. gr. j., pulv. rhei gr. ij., pulv. hyd. gr. j. in pil. every fourth night. Warm clothing. To take only milk, or milk diluted with soda- or lime-water. Mist. belæ, mane.

December 14th.—Has followed the instructions as to diet closely. The only solids eaten in the first three or four days have been a little fish and a few small pieces of biscuit; found that taking about a dessert-spoonful of whisky in a claret-glass of water, two or three times a day, almost put a stop to a slight feeling of nausea and faintness which at first was troublesome. For the first two days he had loose stools twice a day, accompanied by a little blood and mucus, but since then only one, the quantity of blood and mucus both decreasing; yesterday and to-day the former were entirely absent, and the mucus only in very small quantity. The stools for four days have been nearly quite formed, and the fæces much larger than any passed for more than two years. Since the second day has suffered from a constant pain in the pit of the stomach, like indigestion, or as if the stomach were filled with wind which refused to be expelled. The stomach is painful on pressure. This he had often felt before, but found relief in taking food. The injection argent. nit. was used once, and it caused little pain, but the inconvenience of using it was so great that he discontinued it. He has had less irritation about the anus, and any pain he felt in the lower bowels has been evidently caused by flatulence. In weight he fell from 10 st. 5 lbs. to 10 st. 2 lbs. in twenty-four hours, and has remained stationary at that since; still feels rather exhausted about five in the afternoon, but thinks not more so than when on ordinary diet. Has been walking two or three miles daily, but has not ridden.

December 31st.—Is much better; all symptoms of diarrhœa and dysentery have ceased. He is taking two to three quarts of milk daily, and no other food.

January 6th, 1881.—Is feeling very well. Had no more dysenteric motions. There is still some thickening about sigmoid flexure of colon. Stools are formed. To continue

the bael every morning. May add a little solid food to the milk on which he has lived almost entirely lately. To take gr. iij. of potass. tart. of iron twice a day.

A few days later he wrote to ask permission to go to South America, apparently feeling quite well. Permission granted, with caution as to diet.

Case 2.—Chronic Dysentery, with Enlarged Spleen.

Dr. McConnell.

R., Mahomedan, aged twenty-five, admitted into Medical College Hospital on April 23rd, 1879; died June 30th. Had been suffering from enlargement of spleen and intermittent fever for three months, with occasional attacks of dysentery. Emaciated; skin dry and harsh; conjunctivæ anæmic; tongue moist, coated with white fur; pulse quick and feeble. No enlargement of liver, but the spleen descends nearly to umbilicus. For five days after admission the fever was distinctly quotidian, and there was no bowel trouble. After the fifth day the temperature fell to normal, and the patient began to improve in condition. On the sixteenth day after admission, dysentery set in with a recurrence of the old symptoms, and he now began to pass eight to ten stools in the twenty-four hours, the evacuations consisting of rosy mucus and blood.

May 15th.—Eight stools in last twenty-four hours; loose, bilious, and containing gelatinous mucus and blood.

30th.—Better; only one stool during the last twenty-four hours, and purely fæculent.

Continued well and slowly gaining strength until June 23rd, when another relapse of the dysentery occurred. From this time to death the disease was unabated and unchecked by treatment. Fourteen or more stools in the twenty-four hours, with rosy or shreddy mucus and blood. He died, quite exhausted and worn out, on June 30th.

Treatment.—While the fever lasted, cinchona alkaloids in seven- to ten-grain doses, with bismuth and soda, were pre-

scribed. When the dysenteric symptoms set in, twenty grains of pulv. ipecac. were given at bedtime, Dover's powder, soda and bismuth, each gr. v., t. d. Latterly, catechu and opium or koorchee mixture, anodyne enemata, lead and opium pill.

Post-mortem Examination (July 1st, 1879; fifteen hours and a half after death).—Body greatly emaciated. Brain and membranes anæmic. Peritoneum healthy. Liver a little shrunken; surface slightly rough; substance mottled on section; the interlobular tissue thickened; the lobules prominent, and the hepatic cells composing them fatty in parts, in others darkly pigmented and ecchymosed. No reaction with iodine. Weight of liver 2 lbs. 4 ozs. Gall-bladder half full; bile thin, of a turmeric-yellow colour, and measures about half an ounce. Spleen enlarged; capsule thick and opaque; substance very dark and soft; proper structure almost undistinguishable; weight 1 lb. 2 ozs. Kidneys a little atrophied. Stomach small; mucous membrane slightly corrugated, pale, and anæmic. The mucous membrane of the small intestine has a slate-grey colour in the duodenum and jejunum. The ileum shows *patches* of recent vascularity. No affection of the glandular structures. The mucous membrane of the large intestine from the cæcum to the anus exhibits dark, gunpowder-like pigmentation in smaller and larger patches—the sites evidently of old ulceration. Here and there the gut is puckered by firm cicatrices or ulcers partially healed. The ulcers are found chiefly on the descending colon, sigmoid flexure, and rectum. They are all small, superficial, with sharp-cut, punched-out edges, their margins surrounded by a ring of pigmentation, their bases of rosy-pink colour and ecchymosed. They all possess a more or less indolent, weak, unhealthy character. The rectum shows serpiginous ulceration of the same type. The muscular coat of the bowel is thickened here, but throughout the rest of the intestine all the coats are thinned and atrophic. The mesenteric glands are all a little enlarged and hyperæmic. The stomach contains about six ounces of milky fluid, yellow-coloured from admixture with bile. In the small intestine about the same quantity

of offensive, clay-coloured fluid was found; and in the large gut also some offensive serous-looking fluid.

Case 3.—Chronic Dysentery.

Mrs. H., aged forty-one, seen with Dr. Theodore Williams, November 10th, 1879.

History.—"Had had eight children rapidly; and was much weakened by long residence in India, where on several occasions she had attacks of dysentery, also cough and expectoration, with well-marked signs of phthisical consolidation of the left lung, for nearly eight years. Was much troubled by menorrhagia. For the last month has had persistent dysentery, the motions being frequent, accompanied by much tenesmus. The motions were scybalous, and accompanied by much blood. Tongue foul. Patient greatly emaciated. Pulse weak, but normal in frequency. Temperature normal. A well-marked area of tenderness and thickening, about the size of a crown, could be made out in left iliac region, over the sigmoid flexure. Some tenderness was also observable in the right iliac fossa. Various remedies had been tried—such as ipecacuanha in large doses, starch-and-opium injections, sulphate of copper, and other astringents—but had failed."

"To have oil of turpentine, ten minims in capsule, three times a day. A week later the tenesmus and blood had quite disappeared, and the motions, though loose, were more natural."

Case 4.—Chronic Dysentery, with Multiple Abscesses of Liver, etc.

Dr. McConnell.

B., a Hindoo male coolie, aged twenty-five, was admitted into Medical College Hospital on November 28th, 1873. He states that almost six months ago he suffered much

from "diarrhœa," from which, however, he completely recovered, and has been well until the last eight days, when an attack of dysentery had come on, and he is now passing ten or twelve stools in the twenty-four hours. Is much emaciated; pulse weak, soft, 132; temperature 99·8°. There is pain all over the abdomen, and tenderness on pressure, especially over the sigmoid flexure. The spleen and liver can both be felt enlarged, and on pressure tender. The stools are from ten to twelve in number in the twenty-four hours, passed with a good deal of pain and straining. They consist of a little thin fæculent matter, with a good deal of rosy and shreddy mucus. His condition did not improve, in spite of varied treatment, and, two days after admission, bronchitis, with a good deal of congestion of the lower lobes of both lungs setting in, prostrated him still more. He thus died exhausted on October 7th, 1873.

Treatment.—Dover's powder with bismuth and soda three times a day, with a stimulating expectorant mixture every three hours, anodyne enemata, etc.

Post-mortem Examination (October 8th, 1873; twenty-two hours after death).—Body emaciated. Rigor mortis only present in the lower extremities. Brain and membranes pale and anæmic; slightly softened in consistency. Lungs: Hypostatic pneumonia of both bases; general congestion. Heart: Nothing remarkable; peritoneum healthy; no fluid. Liver large; surface irregular, presenting a series of circumscribed, yellowish-red, slightly projecting nodules, which occupy chiefly the upper surface of the right lobe, and a few also in the left lobe. These vary in size from a pea to a pigeon's egg, and on section are seen to be distinctly circumscribed abscesses, containing from a few drops to nearly a drachm of thick, greenish-yellow pus; each is surrounded by a dark, well-marked hyperæmic zone. The liver-substance is abnormally soft, and exhibits throughout similar circumscribed suppurating foci; in addition to which there are numerous circumscribed points of so-called "red softening" (acute inflammation running into suppuration). No reaction given with iodine. Weight of liver 3 lbs. 13 ozs. Gall-

bladder contains about half an ounce of thick, brownish-yellow bile; ducts free. Spleen large and heavy; the capsule in parts thickened; substance moderately firm, dark reddish-brown; trabecular structure well marked; weight 1 lb. 2 ozs. Kidneys a little fatty, particularly the cortical structure; nothing else remarkable. Stomach small; mucous membrane corrugated, pale; that of the whole of the small intestine also pale; no affection of the glandular structures. The mucous membrane of the large intestine from cæcum to anus presents an almost continuous series of transversely placed dysenteric ulcers; the surfaces of some are covered by dark, shreddy, and easily-detached sloughs; the majority, however, are quite bare and raw-looking, exposing freely the muscular coat. The sub-mucous tissue is here and there irregularly pus-infiltrated, and throughout thickened. The ulcers become larger and more numerous as the rectum is approached. The surrounding unaffected mucous membrane is thick, and for the most part pale or having but a faint rosy blush. Many of the ulcers seem to be of considerable standing, presenting an indolent condition, with pigmented edges. The mesenteric glands are slightly enlarged and soft.

Case 5.—Liver-Abscess and Chronic Dysentery and Diarrhœa.

With Mr. Adams.

An officer, aged forty-five, a man of temperate habits. Had two attacks of dysentery during the last year in Afghanistan, and was left behind at Safed Sung when his regiment marched to Jellalabad.

The second attack was slighter than the first, and occurred on the march down-country. On both occasions he complained of severe pain over the edge of the liver, particularly just below the region of the gall-bladder, and behind under the short ribs.

Since the last attack he has constantly been ailing, now from ague, again from diarrhœa, and occasionally from both together. Occasionally pills and aperient draughts were

prescribed, but up till his arrival in Bangalore in October he was not put under any regular course of treatment. On the day of his arrival at Bangalore he had rather a severe attack of fever, and the diarrhœa increased in severity, the motions being frequent, light-coloured, frothy, and accompanied by a good deal of pain both in the bowels and anus. The pain over the edge of the liver also became much more severe; his appetite also failed, and his nights became restless and disturbed. At first ordered him a bitter tonic, but on the 23rd, after consultation, prescribed—ipecac. co. gr. xx., hyd. c. cretâ gr. xij., sod. bicarb. gr. xx., pulv. iv., one night and morning; also ℞. Acid. nit. mur. dil. ʒiss., tr. aurantii ʒiv., inf. calumbæ ℥viij., m.; one tablespoonful two or three times daily.

These he continued to take, but with no apparent benefit; on the contrary, he is becoming weaker day by day. His motions frequent, very loose, light-coloured, and frothy. Taste and appetite gone. Sent to England. The above is an abstract of his case.

I saw him on December 18th, 1880, with Mr. Adams. He had arrived at Southampton on the 15th, and came to London on December 18th; was much fatigued by the journey. He was emaciated and sallow; his skin hot; pulse rapid, 130, feeble; tongue dry, smooth, glazed; bulging and fluctuation behind eighth and ninth ribs; side greatly enlarged; a large liver-abscess was pointing and near the surface; no abdominal pain except over the edge of the liver.

Next morning, December 19th, after rest and sleep induced by a morphia draught, the abscess was opened, under strict antiseptic precautions, by Mr. Adams, assisted by Mr. S. Watson, who made a free incision between the ninth and tenth ribs, in a line corresponding to posterior fold of axilla. The matter was near the surface, and one pint of thick pus, with clots of thicker pus, was evacuated. The edge of tenth rib was found to be necrosed, and a drainage-tube was inserted. He was relieved by the operation; his temperature fell; his breathing, which had been much oppressed, was relieved.

On May 3rd the dressings were changed. The discharge

through the drainage-tube was free, but thick; no putrefaction. He slept fairly, and took nourishment well. The bowels acted occasionally; the excreta were fluid and very offensive.

On the 25th he died rather suddenly, after some symptoms of orthopnœa. There had been an increase in the discharge, with some blood.

The post-mortem examination took place on December 27th, at 9 a.m. The right lung was condensed by pressure into a dense impervious mass, the lower part adherent to the diaphragm. The left lung was healthy. The heart was healthy, but the right ventricle contained a firm white clot, moulded into the pulmonary artery and extending into both divisions for two inches or so. The right pleura contained a quantity of recent lymph. The diaphragm was adherent to the liver below, the lung and the thoracic wall above. The liver was fatty, but it contained only one abscess, which had contracted to the size of a small orange. The liver was closely adherent to the parietes, and the aperture between the ninth and tenth ribs opened directly into the cavity, which was lined with flocculent, semi-puriform lymph. The spleen was about twice the normal size and rather soft. Kidneys apparently healthy.

A careful examination was made of the morbid parts by Mr. Alban Doran, of the Royal College of Surgeons, and the following is his report:—

"December 29th, 1880.—I have examined the intestine to-day. 1. The valvulæ conniventes are absolutely normal, excepting in the part of the ileum where they are nearly effaced; there, they are deeply congested. 2. The muscular and mucous and sub-mucous coats of the transverse colon are much thinner than normal; in the ascending colon there is atrophy of the same coats, but to a less marked degree. 3. The appearance of the mucous membrane is so altered by decomposition, that the slaty colour characteristic of amyloid degeneration cannot be distinguished. 4. Peyer's patches have almost entirely disappeared. In the middle of the ileum, large shreds of desquamating mucous membrane

hang into the lumen of the intestine. Some of these shreds are discoloured, others quite dead-white, precisely like the epidermis when desquamating from sunburn or after scarlatina. 5. There are a few superficial ulcers in the sigmoid flexure, but not elsewhere. The mucous membrane of the rectum is abnormally puckered. 6. The muscular coat of the rectum is much thickened. 7. There appears to have been contraction between the descending colon and the sigmoid flexure, but the intestine had been opened when I examined it. 8. Weight of liver and adherent part of thoracic wall, 6 lbs. 11 ozs. 9. The liver-substance is pale and very soft and greasy.

"Looking at the specimen from the *thoracic* aspect, with the diaphragm placed in its normal position, and then passing a catheter through the wound in the chest into the abscess-cavity, none of the catheter can be seen, and it appears to run clean into the liver. Hence, as you say, the lower part of the diaphragm, with a reflection of pleura, must have become fused to the liver and the chest-wall. About one inch and a half of the tenth rib is necrosed and denuded of periosteum."

This is a very instructive case. The previous history appeared to point to the dysentery and diarrhœa as the cause of the abscess; an example, in short, of multiple pyæmic liver-abscess. It proved, however, to be a single abscess, and the contraction of the cavity, after the removal of more than a pint of pus, was most remarkable. The effusion of lymph in the pleural cavity and on the surfaces, and generally in the vicinity of the abscess, was very remarkable, especially seeing that antiseptic precautions were carefully observed at the time of operation and during subsequent dressing. The fibrinous coagula in the pulmonary artery no doubt accelerated, if they did not cause, death.

There was no peritonitis; and the disease of the bowels was rather that of atrophy and degeneration than of ordinary dysentery.

The case is interesting and instructive, especially in regard to the liver-abscess and the state of degeneration of the intestines.

Case 6.—Chronic Diarrhœa.

Mrs. M. A. S., aged forty. In July, 1866, she went with her husband to Amoy, South China. Up to 1873 had tolerable health, interrupted only by such weaknesses as arose from the great heat, and consequent upon confinements. During that period of seven years she had five children and one miscarriage. At the birth of the last child, in 1873, she caught a severe cold, and lost the use of the right ear, which has never returned. About six months later, bleeding piles appeared, and having always been of constipated habit, her sufferings were great. Had severe pain after the action of the bowels, and hæmorrhage. In March, 1875, she came to England, and in December of that year had an operation for internal piles. Having recovered by the autumn of 1876, returned to China. In January, 1877, hæmorrhage again returned, but without pain, and continued on and off for some months. Her medical adviser ordered her to take plenty of exercise, and to eat fruit very frequently. Was better, and got on till August, 1878, when the monthly illness (after being more than usually profuse) stopped, and her health at once declined. The abdomen became swollen, appetite failed, throat was relaxed, and covered with small ulcers, and she was much exhausted. Milk and port wine were ordered, and she was advised to give up teaching the Chinese. In December she became a little stronger; the catamenia returned for one day, and since that have quite ceased. In February, 1879, the symptoms of weakness all came on again, attended by frequent sick headache and bilious vomiting, till at length she could retain no food, and was so prostrate as to be obliged to keep her bed for some weeks. It was at this time the tongue showed the first appearance of soreness, and she lost flesh considerably. All through the spring and summer she had regular attacks of sore tongue and vomiting. The rule was, to be one week ill and the next better and able to eat. This went on till the middle of July, when the state of the tongue was very bad; her mouth inside and lips

became much swollen. For the burning, shooting pains she got relief by sucking ice for several hours. As soon as the inflammation subsided, she was sent away to Chefoo, North China, to avoid the intense heat, which greatly aggravated the disease. She had not been twelve hours at sea when diarrhœa set in violently. In a week she arrived at her destination greatly prostrated, went to bed, and the next day had (as it was thought) an attack of English cholera. The worst symptoms soon yielded to remedies, but the diarrhœa continued unabated for a period of seven weeks, attended by bleeding from piles. The action of the bowels in appearance was like small seeds and water, and very fœtid. The diet was milk, beef-tea, chicken soup. Had Dover's powders, opium, bismuth, and charcoal, till a doctor at Chefoo prescribed acid. This changed the nature of the diarrhœa to a more healthy form, but left her more prostrate than before. During all these weeks her tongue was quite free from soreness. Being very desirous to take a little meat and ale, it was allowed, and the diarrhœa gradually passed away. As the weather was now getting cold, and she was a little stronger, she was advised to return to Amoy. On reaching Shanghai, it was quite hot, her tongue became sore, and very fœtid diarrhœa again set in. In this state she went on board, feeling as though she would die of hunger, and yet quite unable to take food, or even liquids, as everything returned. Before arriving at Amoy the vomiting and diarrhœa had partially subsided. Landed on October 4th, and the disease again took the regular form of better and worse till the winter set in; then the attacks of sore tongue and sickness (though coming with the greatest regularity as to time) became less in severity, but, as the diarrhœa was not checked by the colder weather, she was ordered to go to England, and left on March 4th last. As she got into the hot climate the disease rapidly increased, diarrhœa took the dysenteric form, and bleeding piles appeared. Coming through the Red Sea the weather was very trying—a dry, hot wind blowing—and she had very severe attacks of cramps all over the body, which lasted an hour at a time, accompanied by faintness and coldness.

Relief was obtained by bottles of hot water being placed all about her. As she got into cooler weather she became rather better, and the last three days at sea was able to take a little solid food. The day after arrival (April 30th) excessive diarrhœa, with sore tongue, again returned—continued—and she grew worse than ever. A bad cough, shortness of breath, and great prostration came on, with loss of flesh to such an extent that she became nearly a skeleton. It was in this state (just three weeks after landing), on May 22nd, she began to take milk only as diet, and the bael fruit as medicine. In *five* days the bad symptoms all subsided. Cough, short breath, flatulence, nausea, vomiting, heartburn, and diarrhœa passed away, and her stomach felt calm, cool, and comfortable. The greatest discomfort was that of real hunger, which, however, diminished when she got to three pints of milk daily. The bowels acted mostly twice a day, in very large quantities of pale formed substance. The tongue continued sore with only one short interval till June 15th, when it began to heal, and by the 23rd it was quite free from soreness, and began to increase in size and healthy appearance from that time. She had also been gaining flesh and strength ever since. About the middle of July began to take *three* quarts of milk, and continued on this quantity till September, when she was allowed a little beef-tea and macaroni once a day in addition. Had no other change till October 26th. For a period of five months she lived on milk alone, and derived the greatest benefit, combined with retaining the recumbent position for nearly the whole of that time. She writes that the change in food has done her no harm, and that she is in a fair way of fully regaining her health and strength.

I may add that I saw this patient, of whose history the above is an abstract of her own statement, some time after this account was written. She had greatly improved in health, and was contemplating a return to China.

Case 7.—Chronic Diarrhœa.

J. B., aged thirty-four, a tall man, much emaciated; complexion sallow; tongue red and smooth; weak, but not feeling otherwise ill; thirst and appetite rather above the average. Has been in India for some years, and has been suffering from chronic white diarrhœa. The following is a brief statement of his case by himself:—"First went to India end of 1863, and resided in Assam; came home early in 1871; returned in 1872; came home again in 1876, and returned end of the year. During the whole of this time had kept good health, but usually had slight attacks of fever and ague during rains and beginning of cold weather. Usual weight eleven stones, or a trifle under. End of May, 1879, had a bilious attack and fever and ague. Did not get quite right again, and in June had a return, followed by diarrhœa. At the end of the month left by steamer for Calcutta and then to Ceylon; stayed a fortnight. Diarrhœa increased, but otherwise felt pretty well. Arrived home at end of August; had medical advice, but diarrhœa still increased, always coming on at night. At last increased to three or four motions daily, and two or three at night. Ravenous appetite the whole time. With the exception of weakness, did not otherwise feel very ill. Came under treatment early in December, 1879. Lived on milk only for six weeks, taking also bael mixture. After two or three weeks diarrhœa decreased, particularly at night, soon after entirely ceasing at night. I then took to arrowroot and puddings, afterwards eggs and fish. By the spring I was in pretty fair health. At this time I was taking steel and also bael conserve. Felt very well by summer, and my weight increased to twelve stones. When at the lowest I scaled nine stones two pounds; I am now twelve stones four pounds. My tongue became very sore soon after leaving Calcutta; I did not care to smoke, neither could I take anything highly seasoned. Tongue became worse afterwards, bright-red in appearance, and a glazed look. Soon after taking milk only

my tongue improved, so I could enjoy smoking, and, with slight relapses, it has gradually returned to its original state."

In March, 1880, he was perfectly well, tongue normal, and for some time had been taking his ordinary food.

Case 8.—Tropical Diarrhœa.

With Dr. Hooper.

"F. P., aged forty-eight, formerly a stockbroker. He had arrived in England the day before from Burmah. Found him much wasted, extremely feeble; skin dry and shrivelled; legs œdematous from groins to toes; hair thin, dry, scanty; teeth loose and decaying, and gums soft and spongy; tongue smooth, red, glazed, like half-dried steak; mouth sore, with a few aphthous patches; spots, cracks, and scales of a reddish-brown colour upon calves of legs and shins; face freckled and tanned by the sun, but generally anæmic. Great craving for food; flatulent rumblings in bowels. Stools six or eight or more daily, pultaceous, white, and horribly offensive No bile in skin, conjunctivæ, or urine. Liver apparently shrunken, its area of dulness hardly reaching margin of ribs. Area of splenic dulness also very limited. No evidence of heart or lung disease. Urine clear, pale, containing neither bile nor albumen. Pulse 80, soft; temperature 98°. No history of intemperance or of syphilis. Says he had 'low fever' in Burmah once for a few days."

Treatment.—June 9th.—Gave him some succus taraxaci, gentian, and nitro-hydrochloric acid ter die, and five grains of Dover's powder om. n. Diet, arrowroot and milk, rice and eggs, Brand's essence of beef, some good grapes, and a little claret.

14th.—Finding more diarrhœa, I ordered a diet of milk (chiefly) and farinaceous food, and gave two grains and a half of quinine ter die.

21st.—No better. Stools very numerous, thinner and yellower than they were; to-day like yolk of egg and milk

whipped together, with surface frothy, sediment chalk-like, horribly fœtid. Œdema limited to dorsum of each foot; tongue clean, red, smooth, dry; seems to be losing power.

24th.—Saw him in consultation. Milk only was ordered; a little spirit might be given, if the condition of patient should urgently demand it, but not otherwise. All the organs were shrivelled and wasted—liver, spleen, intestines, etc.

Treatment.—1. A wineglassful of milk every hour. 2. Rub gums with a soft brush and eau de Cologne. 3. Wash mouth with a wash of ʒj. of borax, ʒj. chlor. potash, ʒij. tinct. myrrh, and ℥viij. water. 4. To take at 7 a.m. and 4 p.m. half an ounce of the following mixture:—Mist. belæ ℥vij., tr. eucalypt. rubr. ℥j., m.

28th.—No stool for last sixty-two hours. Pulse 80; temperature 98°; but gets thinner and weaker (*i.e.*, we all think so).

July 5th.—Stools much less frequent than on June 21st, and much less fluid—now *just like putty.* Does not appear to gain flesh or strength; seems thinner *if possible.* Craves for something substantial.

8th.—Being so thin and weak some corn-flour was added to the milk; but the stools at once became more fluid and more frequent, so we returned to milk pure and simple; and although many times after this a similar alteration was tried, the result was always the same. Soon after this the case went out of my hands. Mr. P. left Camberwell, and I heard nothing of him till about the middle of October, when, to my astonishment, his mother wrote to say that he had just *walked into her house*, and although thin, he was full of life, hope, and spirits.

The above is an abstract of Dr. Hooper's account of this case.

I saw him in October, 1880; he was quite well.

On February 4th, I hear that he is not in so satisfactory a condition, but that he is eating and drinking like other people, and able to walk five or six miles daily.

Case 9.—Tropical Diarrhœa, with Albuminuria.

Abstract of Case by Dr. Daniel, Epsom.

"Captain T. left England for Burmah in June, 1864, and arrived there in October. When in Burmah he was quartered at Tonghoo, and while there (in 1866) had insolation, and for more than a month afterwards was unable to retain anything in his stomach, and ever since that time, until a few weeks ago, the three outer fingers of both hands were benumbed, which numbness was felt as far up as the elbow. Since that time he has been subject to attacks of cramp, in both legs and hands, the acuteness of which has varied; but during the last few months these have ceased.

"He left Burmah for Madras in February, 1868, and was quartered at Bangalore until invalided from there in August, 1869, for disease of the liver, and he so far recovered as to be able to return to India in February, 1871. He was then quartered in Calcutta, and there had a slight attack of cholera. At his next station, Allahabad, he had a few slight attacks of simple fever. He returned to England in November, 1872, and again left for India in February, 1875, and joined his regiment in Raneket, N.W.P. He again left Raneket for England in November, 1876, and during the latter part of the stay in that place he suffered at times a burning sensation when making water, and experienced considerable pains across the loins, which were increased by riding. These pains increased on the voyage home, and became still worse in England. On his return to England in 1877, he was quartered at Portsdown Forts, Parkhurst, and Aldershot, and finally retired from the service on May 1st, 1880.

"I first saw Captain T. after his return from India in 1873, and found him suffering from enlargement of the liver to the extent of nearly three inches below the ribs, and ascites filling about two thirds of the abdominal cavity. This was accompanied by dyspnœa, irregular and intermittent action of the heart, and frequent attacks of cramp-like pain in the chest,

which was generally relieved by diarrhœa and vomiting. There was also occasionally albumen in the urine. In the course of a few months most of these symptoms disappeared, though occasional vomiting and diarrhœa continued. He left for India in 1875, and at the end of two years returned to England, when I again saw him. At that time the liver was not much enlarged, but the action of the heart was irregular and the albumen more persistent. In the spring of 1880 I again saw him. He had shortly before been thrown from his dog-cart, which seemed to have shaken him considerably. He looked sallow and emaciated; the heart's action was at times feeble and then again tumultuous; the urine contained casts, mostly of a hyaline character, as well as albumen. The liver was only slightly enlarged, and there was no dropsy. Was prescribed iron and iodide of potash. In the summer he went for change of air to the West of England—Torquay, Falmouth, etc.—but his strength seems to have steadily decreased, and he returned home in October. He was then excessively emaciated, sallow, hardly able to walk without falling, with weak cardiac action, and almost constant sickness and diarrhœa. On November 19th, 1880, the fresh bael fruit and a diet consisting solely of new milk were ordered. After the adoption of the milk diet, the sickness and cramp-like pains ceased, and a few doses of the bael only were required to check the diarrhœa. At first two or three pints of milk were taken, but at the present time (January) he takes nearly four quarts daily and nothing else, either nourishment or stimulant. His improvement has been constantly progressive, with the exception of one slight bilious attack, and he appears to be recovering his health rapidly; his strength and weight have increased, his bowels act regularly, his sleep is undisturbed, and he has in a great measure lost his former sallow, cachectic look. His urine, which shortly before December 9th contained some casts and a trace of albumen, is now quite free from either."

On January 25th, 1881, Dr. Daniel writes that he is rapidly recovering. His weight has increased from nine stones eleven pounds to eleven stones five pounds in a

month. Heart's action normal. Bowels act regularly; no albumen in urine; portion of liver still indurated. May add a little bread to his diet.

I saw this patient on the 3rd of this month (February, 1881). He had grown very stout; was strong and well. Weight, nearly twelve stones. His tongue natural, except a small portion near the tip, which is still smooth. He is now to resume gradually his ordinary diet.

Case 10.—Tropical Diarrhœa.

With Dr. Pilcher.

R. H. P., aged thirty-four, went to India in 1871. For the first eighteen months was in the Central Provinces, and then went to Burmah. Lived in various towns in British territory till November, 1875, when he removed to a large station in Upper Burmah. The hot weather there was very trying, and it was impossible to take a due amount of sleep and exercise while it lasted. Had hitherto been abstemious, but during 1876 and the early part of 1877 he commonly drank a couple of glasses of spirits-and-water in the evening, besides a bottle of light wine at dinner.

In June, 1877, on his way down the Irrawaddy to Rangoon, got dysentery. Was five or six days before he could get medical aid. Not knowing what was the matter, he used chlorodyne to ease the pain. When he got to Rangoon had fever with the dysentery, and the medical officer seemed to think him very ill; recovered, however, in a week or so, on milk diet, ipecacuanha, and quinine.

A fortnight later he had another attack of dysentery, which left him in about the same time under similar treatment.

For the next two or three years he had hard sedentary work, which often compelled him to take food and rest irregularly; but for fifteen months after the second attack of dysentery, though troubled with more or less alternate loose-

ness of the bowels and constipation, suffered from no specific disease that he was aware of. All the cold weather, November to March, of 1878-9 used to have copious loose motions every morning; but the medical officer whom he consulted said this was a common thing in cold weather, and was of no consequence.

In April, 1879, he got a third attack of dysentery, rather milder than the two former—indeed, none of his attacks were very acute. Suffered a good deal of pain in the first two, and passed albuminous or mucous matter, but lost little blood. From this third attack he recovered as quickly as before, but not so thoroughly. Continued to have loose motions from time to time, and occasionally noticed traces of blood in his excreta.

In May, 1879, while he was still weak from the dysentery, had rather a bad attack of fever. The hot fit continued a day or two days, and did not return; but he was very feeble for three weeks after.

As soon as he could move, he was ordered away from Rangoon for a sea voyage, and came to England. Was fairly well all the way. Thought he had completely recovered, and in England ate fruit and drank beer. After a fortnight at home he left for Rangoon again. Found he was not so well as he had been on the homeward voyage. The diarrhœa returned, and, though it did not cause serious inconvenience, he could not shake it off.

Got back to Rangoon in September, 1879, and remained there till February, 1880, when he had two attacks of fever. The first was slight; the second was more severe; as soon as he got well (which was in a fortnight or so) had to leave for England again.

Reached England in April, 1880, still suffering slightly with diarrhœa. The doctors he had consulted said he would get well in process of time in a cold climate, and during the summer he was under no treatment. Was careful in his diet, and occasionally took three-grain pills of ipecacuanha at night, but with little effect. Continued about the same till August or September, 1880. Latterly was much annoyed

by flatus and rumbling in the bowels, and was usually more uncomfortable in the morning than at night.

At last, whether owing to a chill, to drinking beer one day, to over-exertion, or to some other cause, the diarrhœa became seriously aggravated, instead of getting better gradually as he had been led to hope. He then resolved to seek further medical aid, and on October 14th was told he had "tropical diarrhœa," coupled with some thickening of the bowel, and anæmia. Was told to live exclusively on milk, whilst iron and quinine were prescribed, also to paint iodine over the region of the cæcum. He followed these directions strictly for nine weeks. The diarrhœa ceased as soon as ever he left off taking solid food, and it never appeared again but on one day. He has been pretty uniformly constipated instead, and has had to take aperients two or three times a week. His ordinary weight is from ten stones eleven pounds to ten stones three pounds, height being five feet eight inches and a half. When he first began to live on milk, he went down gradually for seven weeks to nine stones thirteen pounds, and then in the ensuing fortnight increased a couple of pounds. Towards the close of the ninth week he was allowed to begin, tentatively, to supplement the milk, first for a week with bread, next with fresh meat finely minced for a similar period, and finally with vegetable and other food, as he chose. He has taken bread for four days without any ill effect.

The above is an abstract of his case furnished by the patient himself.

December 19th.—Evacuations normal.

21st.—Evacuations normal.

I heard after this that he is still improving; no doubt he will recover if he have patience to keep to the diet ordered.

Case 11.—Chronic Diarrhœa.

Dr. McConnell.

M. R., East Indian female, aged seventy, admitted into Medical College Hospital, Calcutta, May 7th, and died August

9th, 1874. Had been suffering from looseness of the bowels for the last six months; on an average eight to ten stools daily. Is much emaciated and very weak. Tongue smooth and glistening; appears almost destitute of epithelium. Abdomen generally tender on pressure, but at no one point in particular. The stools are very thin and pale-coloured, passed without any pain, griping, or tenesmus, and quite free from both mucus and blood. Under treatment the patient improved for some time, the diarrhœa becoming less, and she gained a little flesh; but on July 6th the diarrhœa again set in, and continued unchecked, in spite of all remedies and all care in diet, and she died, exhausted and worn out by the disease, on July 9th.

Treatment.—Careful dieting, principally milk, and astringents, especially nitrate of silver and sulphate of copper, in combination with opium.

Post-mortem Examination (July 9th, 1874; five hours and a half after death).—Body feebly nourished. Rigor mortis slight. Pupils dilated; arcus senilis in both corneæ. Brain and membrane anæmic; the vessels of the circle of Willis thickened and atheromatous. Both lungs highly emphysematous, and the bases a little congested. Heart atrophied. Peritoneum pale and glistening; no fluid. Liver: Capsule everywhere slightly hazy; substance of a pale fawn (yellowish) colour; very soft, friable, and anæmic; gives no reaction with iodine; weight 2 lbs. 5 ozs. Gall-bladder small and contracted; bile-ducts free; bile thick and dark green; measures only a drachm; in the gall-bladder is also found a pure cholesteric calculus, white and brilliant, the size of a sparrow's egg. Spleen small and contracted; capsule dark and opaque; on section, dark, soft, pulpy; weight 3½ ozs. Kidneys both in a far advanced stage of cystic degeneration, and the pelves and calyces are much dilated, and show a corresponding atrophy of the secreting structure. Stomach small, mucous membrane thin, of a brown or greyish-brown colour; the mucous membrane of the duodenum and jejunum presents nothing remarkable, but throughout the ileum there are found at short, irregular intervals, small, superficial, weak-looking

ulcers with pigmented bases. The whole of the small intestine is much thinned, its coats semi-transparent; but this is most marked in the ileum. The mucous membrane of the large intestine presents a dark slate-colour from extensive pigmentation of the surface, but there are no glandular lesions, ulcerations, etc. The stomach contains about ten ounces of greenish bilious fluid; the small intestine about three ounces of similar fluid, but thinner; the large gut half an ounce of muddy-coloured fæcal matter. The mesentery is loaded with thick yellow fat. The glands are slightly hyperæmic, not engorged.

Case 12.—Morbid Preparation.

Case of a native male adult, who died in the Medical College Hospital, Calcutta, from chronic dysentery. The whole of the mucous membrane presents a thickened, corrugated, honeycombed appearance, is covered with innumerable small, irregular-outlined ulcers, the majority of which, in the lower part of the bowel, reach the muscular coat, which in turn is softened and shreddy; a few have penetrated still more deeply, and have almost perforated the gut.

No details of the history of this case are supplied, but it is a good example of the sort of pathological lesions that may be found in cases of chronic dysentery.

Case 13.—Morbid Preparation.

A case of chronic dysentery in a native male Hindoo, who died in the Medical College Hospital on December 4th, 1875. A portion of the transverse and descending colon, with the sigmoid flexure and rectum preserved, showing extensive chronic indolent dysenteric ulceration of the mucous membrane, with very dark pigmentation of the ulcers and surrounding tissue, and thickening of the muscular coat.

This also is an excellent illustration of the pathological condition and morbid anatomy of the bowel in chronic dysentery.

In concluding, I must express the great obligation that I am under to Professor Aitken, F.R.S., of Netley, for the valuable preparations he has allowed me to place before you from the Netley Museum, as well as for much valuable information derived from his writings.

I am especially indebted to Dr. McConnell, of Calcutta, for the interesting recent specimens and cases with which I have been able to make these lectures, I hope, of some practical value; to Drs. K. McLeod, Cayley, and Chundra, of the Medical College, for their valuable clinical contributions; and to Dr. Jones, of the Calcutta General Hospital, Dr. Coull Mackenzie, and Moulvie Khan Bahadoor Tameez Khan for most valuable reports; to Mr. Buckland, of the Civil Service, for valuable information regarding the shipping population of Calcutta; to my old friend and colleague, Dr. Chevers, for his valuable communication on the exuviæ of dysentery; to Surgeon-Major Dr. A. Clarke, A.M.D., and Fleet-Surgeon Dr. Lilburn, R.N., for valuable statistical information; to Mr. Alban Doran, of the Hunterian Museum, for the care with which he examined and reported on certain morbid specimens; and, lastly, to the sanitary officers, who are doing such important work in India, and to the many authors, ancient and modern, from whom I have derived information.

It only remains for me to thank you, sir, and the members of the Society, for the indulgent patience with which you and they have listened to me.

ON THE BAEL FRUIT, AND ITS MEDICINAL PROPERTIES AND USES.*

Having recently received from Calcutta some specimens of the Indian bael fruit, which arrived in perfect order, I take the opportunity of directing attention to a remedy of considerable repute in India in the treatment of some forms of bowel complaint, and which I think might be of use in those forms of chronic diarrhœa and dysentery that are seen in persons who return to Europe after residence in India or other tropical climates.

The bael is already well known, and is included in the list of drugs in the British Pharmacopœia, where it appears in the form of the dried fruit and the liquid extract, which is "prepared from the half-ripe fruit brought from Malabar and Coromandel"—known in fragments of a brownish-orange-coloured dried pulp adhering to the rind of the fruit. It has been, says Mr. Squire in his valuable commentary on the Pharmacopœia, "extolled in the treatment of diarrhœa and dysentery, and is given alone or in combination with other astringents, such as the red gum of the Eucalyptus rostrata."

This liquid extract of bael is prepared by macerating the dried fruit in water and rectified spirit. The fluid is to be evaporated, pressed, and filtered; an intensely brown fluid is the result, of which ʒj. to ʒij. may be given as a dose. This and the dried fruit are the only officinal forms in which it is known, so far as I am aware, in

* From a Lecture delivered to the Students of the Charing Cross Hospital in 1877.

this country; and though I do not wish to disparage them —for I really know little of their properties in this state— yet I imagine they have neither deserved nor acquired much repute as medicines. I think the case is different in regard to the fresh fruit and its preparations, and to them I wish to call attention, for it is quite possible, in these days of rapid communication, to procure supplies direct from India; it is well that you should be acquainted with a remedy that often proves valuable there. Do not suppose that I wish you to think of the bael fruit as an unfailing or specific remedy; it is nothing of the kind, but simply one that is occasionally very useful in some forms of chronic disease, where other remedies fail. It has the advantage, moreover, of being simple, and easily procured. I am an advocate for utilizing the local remedies of the countries in which one may live, and would recommend you to make yourselves acquainted with them as much as possible, not merely as a matter of economy, but because it renders you more independent of costly European drugs, and because it is right to develope and encourage the use of such as are really reliable and effective; and there are many native remedies that might with advantage be introduced into European practice.

The example to which I now invite attention is the fruit of an aurantiaceous tree, known to botanists as the Ægle marmelos. It is common nearly all over India, and everywhere is held in much esteem, and indeed veneration, by the Hindoos, who regard it as a sacred tree, its ternate leaf being considered as a type of the Hindoo trinity, or of Sivà, a member of the sacred triad. It is, moreover, thought to be pervaded by the presence of Durga, or Kali, the wife of Sivà, and hence has a double odour of sanctity, and is much grown around pagodas and temples. It is valued not only on this account, but because its fruit, leaves, bark, and wood are all thought to be endowed either with medicinal properties, or to be of value in other ways. I propose to consider only the medicinal properties and uses of the fruit.

Descriptions of the tree may be found in most works

on the botany of India. Dr. Cleghorn—a high authority on all that regards Indian forest and plant life—has given an account of it in the *Indian Annals of Medical Science*, and he tells us that it has many synonyms, of which the following are some:—Ægle Marmelos (Wight and Arnott), Feronea Pellucida (Roth), Cratœva Marmelos (Linn), Belva Bilva, Maridu (Sir W. Jones, in "Asiatic Researches"), Cov-alum (Rheade Hort. Malabar), Bael, Bil, or Bela (Hindi Bengali), Beli (Cingalese), Naraidu (Telinga), Tanghala (Malay), Willamaram (Tamul), Bengal Quince, Stone Apple (English).

In Bengal and Northern India it is commonly called Bael or Bel.

The tree is moderately large—twenty, thirty, to forty feet high; the branches are irregular and not numerous. The leaves are ternate, and dotted like those of other orange trees; flowers are whitish and sweet-scented. It has sharp strong axillary thorns, which are more numerous in the wild, uncared-for, stunted trees growing on poor ground than in the cultivated trees, on which also the fruit are much larger and more highly flavoured than on the former. The fruit is a large globose or obovate hesperidium or orange, of varying size, from a small orange to that of the individual before you, with a hard woody rind, with a fragrant aromatic epidermis. The interior is a yellowish aromatic and astringent pulp, with a pleasant and peculiar flavour. It contains ten to sixteen cells, each lodging a tomentose seed, imbedded in a tenacious viscid transparent mucus, which has a peculiar, somewhat terebinthinate flavour. The rind is pungent and aromatic, with essential oil. As I have already remarked, the tree is sacred to Sivà, and the worship of this god, under the name of Mahadeo, is prevalent everywhere throughout India. "The daily ceremonials are of a severely austere and simple character," says Monier Williams; "water from a sacred river is poured over his symbol, with perhaps a few oblations of flowers, but often there is nothing presented by the worshippers but the Bilva, or bael leaf."

The following description of the tree is by Dr. Brandis, F.R.S., the Director-General of Forests in India:—

"*Ægle Correa.*—Leaves alternate, trifoliolate; leaflets pellucid, punctate. Flowers bisexual. Calyx small 4, 5, dentate, deciduous. Petals 4, 5, imbricate. Stamens numerous, with short subulate filaments, and long linear anthers. Ovary on cylindrical disc, with a fleshy axis, and 10 to 20 small cells near the circumference, with numerous ovules in each cell attached to the central angle. Stigma capitate, obtuse, deciduous. Fruit globose, with hard, woody rind, 8 to 16 celled, filled with an aromatic pulp. Seeds numerous, oblong, flat; testa woolly, covered with a viscid fluid. I. Æ. Marmelos, Correa; Roxb. Cor. Pl. t. 143; Fl. Ind. ii. 579; Wight and A. Prodr. 96; Wight Ic. 16; Bedd. Fl. Sylv. t. 161. The *Bael* tree—Sanscrit *Bilva*, *Mahura*. Vernac., *Bel*, *bil*, *bila*, *bili*. Local name *Mahaka-marra*, Gonds., C. P.; *Ushitben*, Burm. Glabrous, armed with axillary, straight, strong, sharp spines one inch long or more. Leaflets three, rarely five, ovate-lanceolate, crenate, terminal long-petiolulate, lateral nearly sessile. Flowers greenish-white, with a fine honey scent, or short lateral panicles; pedicles and calyx pubescent. Calyx flat, teeth indistinct. Petals oblong, coriaceous, thickly dotted. Filaments occasionally fascicled. Fruit globose, oblong, or pyriform, two to five inches diameter, with a smooth grey or yellow rind, and a thick orange-coloured, sweet-aromatic pulp. Wild in Siwalik tract and outer Himalaya, ascending to 4,000 feet, from the Jhelum to Assam; also in Oudh, Behar, Bengal, Central and Southern India, and Burmah. Often gregarious when wild. Cultivated throughout India, except in the northern part of the Punjaub; frequently planted near Hindoo temples. Leaves shed about March and April; the new foliage appears in April and May. Flowers about May; and fruit ripens in October, November; remains long on the tree. When cultivated, a middle-sized tree to thirty-five feet high, with a short, erect, often fluted, irregularly-compressed, and scooped-out trunk, attaining a girth of seven feet; branches few, extremities often drooping, forming a

narrow oval head. Wild (in North-West India) generally a small scrubby tree. Bark of trunk and larger branches half an inch thick and more, outside soft, corky, light cinereous or bluish-grey, with large dark stains, and irregular, longitudinal, shallow furrows. Wood light-coloured, mottled with darker wavy lines and small light-coloured dots; medullary rays indistinct; even, close-grained, forty to fifty pounds per cubic foot. The tree, being valued for its fruit, is not often felled; but the timber is esteemed for strength and toughness. Used in construction for pestles of oil and sugar-mills, naves and other parts of carts, and for agricultural implements. Twigs and leaves are lopped for cattle-fodder. The tenacious pulp of the fruit is used medicinally in diarrhœa and dysentery, as sherbet, and as a conserve. Dry, it keeps well as a hard, transparent substance. It is also considered as an excellent addition to mortar, especially in building walls. Snuff-boxes are made of the shell of the fruit; the leaves, root, and bark are used in native medicine; from the flowers a scented water is distilled.

In 1868 a Pharmacopœia for India was published, under the auspices of Government, edited by Dr. John Waring, a distinguished member of the Madras Medical Service. This valuable work is based on the British Pharmacopœia, and, while affording all the information contained in that work of practical use in India, embodies and combines with it such supplementary matter of special value in that country as should adapt it to meet the requirements of the Indian Medical Department. In this work the following description is given of the forms in which bael is prepared for use:—

1. Bael mixture (sherbet): "Two ounces of the pulp, two ounces of white sugar, four ounces of water; mix them thoroughly and add ice; it may be strained through linen, and is an agreeable form in which to take it, and is so taken by many in India when the bowels are deranged; for its beneficial action in giving tone to the intestinal tract. It is generally taken early in the morning, and may be repeated

twice or thrice daily to the extent of a large wineglass or small tumbler full."

Waring says:—"It possesses all the aroma of the fruit, and when prepared with ripe fruit is not only astringent when diarrhœa exists, but possesses the singular property of being aperient if the bowels be irregular or costive. When the patient is much reduced in strength, and the stomach is irritable, the above mixture sometimes disagrees. It might then be given in smaller and repeated doses, and if these are rejected the extract *may* be tried."

The Liquid Extract (Ext. Belæ Liquid.):—"Take bael fruit 1 lb., water 12 pints, rectified spirit 2 fluid ounces; macerate the bael for twelve hours in one-third of the water, pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining two-thirds of the water; press and filter the mixed liquors through flannel, evaporate to fourteen fluid ounces, and when cold add the rectified spirit;" dose from one to two drachms. This extract, prepared from the dried bael imported into England, appears to possess much less medicinal power than the extract and mixture prepared from the fresh fruit in India.

This, indeed, is the preparation of the British Pharmacopœia, about which I have already expressed doubts as to its activity.

The Extract of Bael (Extract. Belæ), made from fruits that are ripe and have thin shells or rinds:—"Extract the pulp, place it in a vessel, add water sufficient to cover it, stir for two hours, and strain through stout calico. Repeat the process until the fluid which passes is tasteless; evaporate over a water-bath to the consistence of a soft extract." This preparation retains all the aroma of the fruit. Dose from half a drachm to one drachm twice or thrice daily. It is said to keep better if made from the unripe fruit.

There are other forms in which it is administered; I will mention the most important of them.

Mr. A. Grant, of the Bengal Medical Service, describes several, in a paper in the *Indian Annals*, vol. ii. of 1855, in use in Bengal; for example:—

"The unripe fruit, squeezed and kept exposed to the air for a whole night, is then boiled and strained and sugar added. Of this a wineglassful is taken twice a day." He says the bael is known to be carminative in the form of preserve or syrup.

The syrup is prepared thus:—Pulp of bael and sugar, each 2 tolas = ʒxj.; Issofgool (Plantago Isphagoola) bran, 6 mashas = ʒjss.; rose water or confection of roses, 1 tola = ʒvj.; water a wineglassful; mix; give three or four times a day.

In dysentery the following formula is used:—Bael mixed with dried shell of Garcinia mangostana, ʒj; flour of pomegranate, ʒj.; syrup of bael, ʒvj.; mix for a dose three times a day. As to the use of the bael sherbet I have already described, Mr. Grant makes the following remarks, in which I quite concur:—"It is not only astringent, but possesses the property of being aperient if the bowels are irregular or costive; this last quality it seems to derive from being stomachic and promoting assimilation. When the patient is much reduced in strength, and his stomach weak, the sherbet sometimes disagrees; it ought then to be given in smaller doses."

Bael marmalade, according to Mr. Grant, is prepared in the same way as orange marmalade. It is eaten on bread, and is said to keep well.

Dr. J. Jackson gives the following recipe for bael conserve:—"Take forty bael fruit, pass the pulp through fine muslin (no water to be added), take 12 lbs. of fine white sugar, boil it into syrup, then add the bael, and boil them together over a slow fire until the whole is made into a jelly."

"But," says Mr. Grant, "as at times, however, all the above preparations will, either from their bulk or sweetness, disagree with the patient, it becomes an object to obtain the medicine in a more concentrated form, more convenient for prescribing." Accordingly, Mr. Scott, of the Government Dispensary in Calcutta, devised the following formula for an extract, which Mr. Grant says he tried with favourable

results. This extract will keep for any time; it retains the aroma and taste of the fruit and its medicinal principles, the starch and other insoluble portions of the fruit only being rejected. Its consistence is uniform, like molasses; its colour dark brown; its smell that of bael. The dose is from ʒss. to ʒj. two or three times in the day, or even oftener. It should be used recent, and he thinks it does not keep so well as stated by Mr. Scott. The extract prepared from the unripe keeps better than that from the ripe fruit. This is the formula:—Take the pulp of the ripe fruit with their shells, put it into a vessel and cover it with water; then churn it as you would churn butter for a couple of hours. Throw this on a calico strainer, and when the whole of the clear solution has passed through, replace the contents of the strainer in the vessel with half the quantity of water, and churn again for a couple of hours; filter as before, and continue to do so until the liquid passes through the filter tasteless. While the process is going on, bruise the shells of six baels and boil them well in two pounds of water, filter the solution through the calico strainer, add to it the filtered solution of the fruit, and having put the mixed solution in an evaporating dish over a water-bath, evaporate them down to the consistence of a good extract. If the medicinal properties of the bael depend on the tannin it contains, this extract, which is made only from the soluble portion of the fruit, must contain it also in all its integrity.

Mr. Scott gave also a formula for concentrated syrup as follows:—One ounce of the extract dissolved in twenty ounces of water, adding eight or ten ounces of sugar-candy; then evaporate it in a water-bath to the consistence of a syrup. The late Dr. Chuckerbutty, Professor of Materia Medica in the Medical College of Calcutta, recommended a preparation of dried bael to be used when the fresh fruit is not procurable, which is the case for some time each year. The pulp is strained through a coarse sieve, and is then kneaded into cakes and baked, to be eaten like a biscuit. This contains all the astringent properties of the fruit, it is said. This process of preparing the dried bael was devised

by Mr. Bowser, the energetic and intelligent Steward of the Calcutta Medical College Hospital.

Other preparations are sometimes made with the bael after it has been partially roasted; and the Hakeems and Kobirajes, I believe, prefer to use it in this form. Dr. Chuckerbutty occasionally recommended the use of the burned bael in the treatment of bowel complaints.

Dr. O'Shaughnessy, in the "Bengal Dispensatory," says:—"The statements we find in works on Oriental materia medica are very various as to the qualities of this tree and its products. Rheade says a decoction of the bark of the root is considered in Malabar to be very useful in hypochondriasis, melancholia, and palpitation of the heart; and that the leaves are used in decoctions in asthmatic complaints. The same authority says that the unripe fruit is of use in diarrhœa.

"Among the Javanese the fruit is deemed very astringent. Roxburgh correctly states it to be delicious to the taste, and very fragrant."

In the "Asiatic Researches," vol. ii., page 349, it is stated that "the fruit is nutritious, warm, and cathartic—a curious combination of qualities—its taste delicious, its fragrance exquisite. Its aperient and detersive qualities, and its efficacy in removing habitual costiveness, have been proved by constant experiments. The mucus of the seeds is for some purposes a very good cement." It is, indeed, remarkable how hard the mucus becomes when dry.

In the "Transactions of the Medical and Physical Society of Bengal," vol. iv., p. 110, Baboo Ram Comul-sen gives an account of the uses of the fruit and various parts of the plant. His botanical description is that given by Dr. Carey, and the following is an extract from the work referred to, giving it in detail:—

"In Bengal the parts of the tree which are employed are the bark, the root and stem, the leaves, and the fruit, both immature and ripe. The bark of the tree is peeled whilst fresh, and a decoction of it is made, in the proportion of two tolas, or about an ounce, to eight chittacks, or about a pint,

of water. It is boiled to one-fourth, and administered in bilious fevers.

"The bark of the tree is sometimes used in fever, but rarely alone, being more usually one of those mixtures which are known as combinations of fourteen or eighteen substances, and given in remittents. When used alone, it is given in a similar decoction as the bark of the root.

"The expressed juice of the leaves, diluted sometimes with a little water, is commonly given in colds and incipient fevers, when the patient complains of general dulness, pains in his limbs, and sense of fulness of the stomach. The juice is slightly bitter and pungent, and induces perspiration.

"The young leaves are also used in ophthalmia, and are made warm, and so applied to the eyes, to relieve pain and inflammation. The unripe fruit is cut into small slices and dried, and a decoction is formed of the dry pieces by boiling them in the same proportion as the bark. It is in this preparation that the medicinal properties of the plant are most decidedly manifested, and the decoction of the dried unripe fruit is a most valuable remedy in diarrhœa and dysentery. It is particularly serviceable in the bowel complaints of children, but is also of benefit in several stages of such diseases in adults. The other forms in which the fruit is employed belong rather to diet than medicine, but they deserve to be noticed as employed in such disorders. A preserve is likewise prepared from the fruit before it is ripe, by boiling with syrup, which is also given to patients labouring under bowel complaints, with benefit, when every other article of food is the cause of fresh excitement, and attended with a feeling of oppression after being taken into the stomach. The ripe fruit is also beneficial in the same way; a sort of sherbet is prepared from it with tamarind-juice, which has rather an opposite effect, but it is on that account beneficial in fevers and inflammatory affections attended with thirst. The glutinous matter about the seeds is used by planters as a size and varnish. The bael is not the less esteemed by the Hindoo that the tree is held particularly

sacred to Mahadeo, and is always worshipped at festivals celebrated in honour of him or his spouse, at the Durga Pooja holidays and similar celebrations."

The medicinal virtues of this plant are probably due to the astringent, aromatic, and demulcent properties of the pulp. It contains a considerable quantity of tannin, essential oil, balsam, and aromatic principle in the pulp, in the rind, and in the tenacious mucus surrounding the seeds. These may be preserved to a certain extent in the dried preparation, but the fresh fruit is in all respects better and more active, and as it can be so readily imported, there is no reason that I know of why it should not be brought into use. There can be no doubt that the bael is a very ancient remedy among the native physicians of India, albeit Dr. Wise does not refer to it in his "System of Hindoo Medicine." It is referred to in the Ayur Veda, the book of Sushruta, a Hindoo System of Medicine, dictated to him by the "holy sage and physician Dhanantwari"—a work still of great authority among Hindoos. It continues to be a favourite remedy among medical men of all denominations in India in the treatment of chronic bowel complaints, and it is not unfrequently given in combination with astringents, such as the kutch or catechu. The specimens before you, which have been in England since March, and are perfectly fresh at the end of May, are remarkably fine ones, and rather larger than those commonly met with—they have been evidently selected—in the Indian bazaars. You will recognize the peculiar fragrant aromatic odour, the yellow colour of the pulp, and the viscid mucus surrounding the seeds, which, Dr. Brandis tells us, is used for various industrial as well as medicinal purposes; a great contrast with the dry form in which the fruit is generally imported, and as you see it here. Mr. Squire has kindly undertaken to reinvestigate the question in its pharmaceutical aspects, and I trust he will succeed in adding some useful preparations of this fruit to our list of remedial agents, and that both in the fresh and preserved conditions it will be brought into use in England.

The bael is not, as you will have gathered from what I

have said, confined to the pharmacy of the Hakeems and Kobirajes, *i.e.* the Mohammedan and Hindoo physicians; it is much used by European medical men, and I have given you most of the formulæ in which it is administered. I will not occupy your time by much further detail on this subject, but may just say that, in addition to the authorities I have already mentioned, others have written on the subject, and if you care to do so you will find descriptions of the plant by Pereira in the *Pharmaceutical Journal*, vol. x., page 165; by Sir R. Martin in the *Lancet* of July, 1853, page 53; by Dr. Horsefield in the "Transactions of the Batavian Physical Society," vol. viii., page 25, and by various learned authors of the last two centuries, such as Burmann, Bontius, Garcias ab Horto, and Caspar Bauhin. Descriptions of the plant and its uses are also to be found in the works of Roxburgh and Wight, Shortt, Newton, Green, Bose, Bidie, Pogson. In a paper entitled "Remarks on the Indian Bael or Bela in Dysentery, Chronic Diarrhœa, and Dyspeptic Disorders," by J. Adolphus, published in London in 1853; also in "Notes on the Nature and Uses of the Indian Bael," by H. O. Renfry, London; Bibl. Manchester Medical Society, 1855; also "Bael ou Bilva, Fruit de l'Ægle Marmelos," A. Collas, *Revue Coloniale*, August, 1856. Dr. Macnamara, late Professor of Chemistry in the Calcutta Medical College, has also recorded an examination of the fruit, in which he compares the ripe and the unripe fruit, in reference to the proportions of tannin or other astringent principles contained in each, and in which he states that the ripe contains more tannin than the unripe fruit, in the proportion of five to three. It contains more sugar, more of the bitter principle and vegetable acids not tannic. He obtained also, by means of ether, a balsam having a strong odour, closely resembling that of Peruvian balsam. This exists in much larger quantities in the ripe than the unripe fruit. He says the astringent properties are due to tannic acid, and that the ripe fruit, containing more of this than the unripe fruit, is more potent.

Dr. Macnamara suggests that the good effects of the bael may be due to the tannin and the balsam. His remarks on

this head are important:—"May not the astringent effects of the bael be due to the tone which it gives to the coats of the intestines, and to its balsam rendering the secretions of the mucous membrane more healthy? It would then decrease the number of stools in a dysenteric patient, or in an otherwise healthy one, but who is liable to mucous diarrhœa; while in a person of constipated habit, given to good feeding, bael might act as a laxative, by keeping the mucous secretions healthy, preserving the tone of the muscular coat, and so enabling the intestines, liable to irritation by peccant matters, to expel the crudities—nay, probably such people would be very liable to diarrhœa if they intermitted the bael; and so, even with them, the bael may really be an astringent."

Sir R. Martin, alluding to the composition of the bael, says in the *Lancet*, in regard to an analysis of the fruit by Mr. Henry Pollock, that "the pulp and the hard shell of the fruit do not appear to differ chemically in any respect except as to quantity. They both contain—(1) tannic acid; (2) a concrete essential oil; (3) a bitter principle which is not precipitated by tribasic acetate of lead, and a vegetable acid. The pulp also contained a considerable quantity of sugar, in which it was preserved. All three of the substances I have mentioned exist in the largest quantities in the rind. There is most acid in the pulp."

Many medical officers in India have used this remedy, and recommended it. The most instructive paper on the subject is one by Mr. A. Grant, in the *Indian Annals*. Dr. Annesley, Dr. Jackson, Sir R. Martin, Dr. Waring, Dr. Duncan Stewart, Dr. E. Goodeve, Dr. Moir, Dr. Chuckerbutty, Dr. Cleghorn, and others have borne testimony to its value as a remedy in chronic dysentery, in diarrhœa, in some dyspeptic conditions, and in bowel complaints of children. I shall refer to some of their remarks on the subject, and then, in conclusion, briefly notice the conditions of disease in which I think the bael is likely to be useful in Europe.

Mr. A. Grant says:—"Given in the form of sherbet it acts as an aperient to persons subject to habitual constipation;

a small tumblerful taken in the morning will produce action of the bowels. In cases where dyspepsia is accompanied by obscure symptoms of land-scurvy, it seems to act favourably, and produce alterative as well as antiscorbutic effects." To this I may add, on my own part, in the irregular action of the bowels, diarrhœa alternating with constipation, when the abdomen is distended, the appetite bad, the secretions defective, and the nervous system depressed, as one so often sees in the damp, tepid atmosphere of Bengal, especially towards the end of the rains, when the mucous membrane of the intestinal canal is disordered and in a state of atony, the bael is not unfrequently an effective remedy, and, at all events, gives some relief, acting either as a laxative or tonic, according to circumstances, by stimulating the bowel to more healthy action, and, combining with the ingesta, seems to promote digestion and assimilation. In the low and chronic forms of diarrhœa, among the weak and exhausted from whatever cause, whether as the sequel of malarious poisoning, fever, or dysentery, it may prove of benefit where opium and ordinary astringents have failed; or it may be still more beneficial in combination with these remedies; and Mr. Grant says that when he wanted to produce a more stimulating effect in asthenic cases, he combined it with the tharrie or palm spirit. He mentions several cases of subacute dysentery successfully treated.

Dr. John Jackson, Dr. Duncan Stewart, of Calcutta, and Sir R. Martin have borne similar testimony to its utility, not only as an astringent, but as a preventive of diarrhœa in persons subject to that complaint, and also as a valuable agent in the treatment of some of the more chronic forms of dysentery. Dr. Jackson speaks favourably of its value in the treatment of the diarrhœa that sometimes follows cholera.

Dr. Cleghorn says it has proved useful not only in obstinate diarrhœa, but in the irritability of the mucous membrane of the intestine that followed the expulsion of tænia by koussa. Mr. Sanderson, a distinguished medical officer of Madras, speaks well of it.

Sir R. Martin made the following remarks:—"On what

the curative property depends I know not; it is certainly not astringent to the taste, or at all events very slightly so. I am inclined to believe that much of its efficacy may reside in the thick mucilage which surrounds the seeds of the fruit. A singular property of the fruit is this, that it does not merely restrain undue action of the bowels, as in diarrhœa and dysentery, but also in cases of obstinate habitual constipation acts as a mild and certain laxative. It may in all cases be said to regulate the bowels."—*Lancet*, July, 1853, page 53.

Dr. Moore, of the Bombay Medical Department, who, at the instance of Government, has written a popular work on medicine, for the use of persons away from medical aid, for which he received the reward offered for the best essay, says:—"It acts as an astringent to the mucous membrane of the bowels, and is also slightly aperient, a union of qualities not found in other astringents. It is useful in chronic diarrhœa and dysentery."

In the March number of the *Indian Medical Gazette*, I find the following remarks by an officer, who—as is often the case in India—being left to his own resources for medical assistance, had been obliged to fall back on such knowledge as he had, or could gather from books, and treat as he best might the complaints occurring in natives or others who were serving under him in that particular locality. India is not a country for specialists, and men holding responsible offices are often obliged to be their own doctors. The writer is Colonel Parsons, Deputy Commissioner of Gujerat, in the Punjaub:—

"My attention was first called to the subject some years ago by a brother officer, when I was stationed in a very damp district, where diarrhœa and dysentery were not uncommon complaints. I was myself attacked with the latter form of disease, which rapidly disappeared under bael treatment. Since then I have frequently been in localities where European medical officers were not always present, and I have suggested and administered the same remedy to both Europeans and natives suffering from either of the

above complaints, and invariably the bael has caused most satisfactory results.

"The subject of the use of bael is not by any means a new one, and I believe the fruit is extensively used for medicinal purposes by Presidency surgeons; but as far as my experience goes, it might with great advantage be much more used in Upper India for the above complaints than it is at present. I feel sure that a great deal of mortality in English regiments from the scourge of dysentery would be saved by the free use of bael fruit, as I have found its effects absolutely marvellous, both as regards rapidity of action and effectual cure. I believe that Pogson's preparation of bael was tried in the army; but I am not aware whether it was considered efficacious. I did not find it of use. The fresh fruit is the best form, but that is not always procurable. I have, however, found Bathgate's dietetic bael all that could be desired, in the absence of the fresh fruit. The mode of administering the fresh fruit I have always adopted is to strain the juice from the pulp through muslin, add a little water and sugar; it then makes a very palatable drink. Two baels a day (this applies to small ones), of the size of an orange, one in the early morning, the other in the evening, I have found sufficient to effect a cure in a very few days, provided animal food be avoided or very sparingly used."

I might easily add to these notices in its favour, but it would be wearisome to do so. I will just remark that you may observe all tell much the same story, and declare it to be a valuable remedy in certain chronic diseased conditions of the *primæ viæ;* but none regard it as a remedy for acute disease. It is a mistake, not unfrequently made, to give remedies at the wrong time; and this is sometimes done in the case of bael, which has been unjustly blamed for not doing that to which it never had any pretensions to do. As a remedy in chronic disease it may be of much value, but it is useless in the acute forms. The conditions in which it is likely to be useful in India I have already indicated; and I must now bring these remarks to a close with a brief

description of the cases in which, if the fresh fruit can be imported, or if the pharmaceutists can make an active preparation, it is likely to be useful here.

In the chronic condition of dysentery into which the bowel is apt to pass when it is thickened, perhaps ulcerated, and indurated from cicatrization, and subject to frequent recurrence of subacute inflammation and dysenteric action, indicated by straining and the discharge of mucus and blood, and where the entire intestinal mucous membrane is sympathetically involved, the use of the fresh bael, taken in the form of sherbet, is likely to be of service. It will not always alone be sufficient, and it may be necessary to combine it with other remedies, such as opium or Dover's powder, but as an adjuvant to these or to astringents it may be beneficial; and from the power it possesses of giving tone to the alimentary canal generally, of improving the condition of the mucous membrane and its glandular apparatus, and of favouring cicatrization, it will not unfrequently aid in producing satisfactory results where other remedies have failed. Vegetable and metallic astringents and tonics, such as kino, catechu, tannin, hæmatoxylon, eucalyptus, Wrightii antidysenterica, pomegranate, sulphate of copper, acetate of lead, alone or combined with opium, frequently give temporary relief, though ultimately they prove insufficient; the disease continues to advance, and the patient to lose ground; the least error in diet, or alteration in temperature or in the hygrometric condition of the air, aggravating the symptoms until change of climate is resorted to. Such cases are not infrequent here, and may be seen on board the homeward-bound steamers and at English and Continental health-resorts. No doubt they have taken the wisest and most effective step for restoration of health in coming home—one in comparison with which drugs are insignificant. In such cases the bael is indicated, and I believe would often materially aid in restoring the diseased intestine to its normal condition. Of course it is not likely to meet all the morbid conditions that may arise in cases of chronic dysentery, and I need hardly remind you that any recurrence of acute

symptoms may need active treatment by ipecacuanha, Dover's powder, injections of opium in solution of gum or arrowroot. In the chronic states of which I speak, I think you will find under its influence that the reparative changes in the large intestine progress quietly and favourably, until cicatrization is accomplished, thickening is removed, and, as far as may be, tone, vigour, and healthy action are restored.

But, unhappily, many cases have not this favourable termination under any circumstances, and the result is fatal, after long and severe suffering; the structural changes in the bowel are beyond repair, and the patient succumbs. In other cases the disease, though not fatal, is very tedious; the cicatrix may be formed, but the gut remains thickened, indurated, and contracted, by loss of the mucous membrane from dysenteric sloughing; the functions of the bowels are imperfectly performed; a condition of chronic disease and suffering remains, diarrhœa, sometimes dysenteric in character, continues, and the patient is worn and wasted by continued suffering. The evacuations are light-coloured—grey, sometimes yellowish; often passed without pain or tenesmus; but at times accompanied by both, and mingled with blood and mucus. These conditions ultimately undermine the strength, and the patient may sink from exhaustion. In the stages that lead to this state of things the bael is more likely to be of service in retarding, if not of altogether checking, the mischief, than remedies that have a more directly astringent action.

Chronic cases of dysentery of a milder character not unfrequently come under our notice. There is thickening and perhaps contraction of the large intestine, which may be felt through the abdominal wall, with or without tenderness on pressure. The general health may be improving, indeed may be fairly good; the appetite, too, good; and all seems comparatively well, except that the bowels are irregular—sometimes confined, at others relaxed. There is straining, and the evacuations are mingled with mucus and sometimes blood. The patient suffers much at times, and is in constant danger of relapse. In this state diet is of the utmost im-

portance; the bowels should be kept regular with occasional doses of oil, or the tepid-water enema. No active drugs are needed, but in such cases the bael sherbet would, I think, be often useful.

Again, either as a sequel of dysentery, or altogether independent of it, an intractable and obstinate form of diarrhœa is met with, especially in persons who have been long in India, China, or other tropical and malarious climates. The diarrhœa sometimes called "alba, or white flux," described by Mr. A. Grant in the *Indian Annals*, is a painless disease, characterized by frequent, liquid, light-coloured, frothy motions, which gradually reduce the strength and exhaust the vital energy. The person slowly wastes and becomes anæmic, his skin is harsh and dry, his abdomen tumid, the tongue red and dry, the papillæ gradually shrink, until in the later stages they disappear altogether, and the tongue becomes smooth, polished, and glazed, or it is coated with white layers of epithelium, which also form on the mucous membrane of the mouth and fauces, often accompanied by aphthous spots.

There is not necessarily evidence of structural changes in the liver or spleen; indeed, there is reason to believe that these organs only share in the wasting or shrinking of the body generally; and so it is found in fatal cases; and also that the whole intestinal tube is thinned, almost transparent, the mucous membrane softened, and the glandular structures wasted or destroyed; not unfrequently a certain amount of ulceration being observed, especially towards the lower portion of the ileum and in the large gut.

Digestion, absorption, and assimilation are all interfered with, and gradual wasting from inanition results. This condition of disease is frequently seen in the hill-stations of India, but most generally in those persons whose constitutions have already been damaged by long residence in the plains. It is also seen in some who have never been in the hills at all.

Early removal to another climate is the best, and, indeed, the essential remedy; and it is, I believe, absolutely neces-

sary, in many cases, to save life. The great mistake generally made is of not resorting to it sufficiently early, and before progressive degenerative changes have gone so far as to be irreparable. In this form of diarrhœa, diet is a most important element in the treatment, and it should be of the blandest, most unirritating kind—milk, animal broths, farinaceous food—which will not always agree, and careful abstinence from over-stimulation either by alcohol or any other stimulant. All forms of medicine have been tried with more or less good effect—opiates in small and repeated doses, either as laudanum or Dover's powder, often giving the greatest and most enduring relief; astringents at times being beneficial, but often failing miserably to do any good.

Now, in such cases, before they leave India, it has sometimes been found that the fresh bael sherbet has produced excellent effects, and done more good than any other remedy. Such are far from uncommon in England in the cases of Indian officers or others, who come home for the purpose of shaking off a complaint that they find is steadily getting worse in India; and it is with the hope of providing a remedy for them that I am anxious that this Indian remedy should be better known in England.

After all, medicine of any kind, however efficacious, is of secondary importance to change of climate, carefully regulated diet, and scrupulous avoidance of chills and cold by wearing extra warmth of woollen dress, which should never be neglected. A remedy that has often produced good results in India, could hardly fail, I think, to be satisfactory here, where it would have the advantage of the improved climate and other conditions of life to give effect to its beneficial action.

LIVER ABSCESS.

(*Read before the Medical Society of London*, 1880.)

The cases on which the following remarks are based present clinical features of considerable interest in relation to disease which, though most commonly met with in India, China, the tropics, sub-tropical or other hot and malarious regions, is not unfrequently seen here in persons who have returned from those climates, but not always with a very definite appreciation of the nature and cause of the loss of health.

The symptoms are sometimes so obscure as to render diagnosis uncertain, and treatment consequently unsatisfactory. I know of few things more difficult in certain cases than the detection of pus in the liver; and it is often long before any certain conclusion can be formed on the point. It may be, indeed, not during life. I shall refer to some points of practical interest in relation to this subject, the time when, and the place where, exploration or paracentesis should be performed.

I had punctured liver abscess in India antiseptically; but this was the first occasion in my experience in which the proceeding was conducted with all the precautions insisted on by Mr. Lister, who, in this case, himself performed the operation, and I am sure he must have been gratified with a result which affords corroborative evidence, were any needed, of the benefits to be derived from antiseptics. I gladly take this opportunity of expressing my appreciation of the value of a system which promises to include this dangerous form of abscess in the ever-widening sphere of its utility, and of thanking him for the kindness with which

he so materially contributed towards the successful issue of a case that will be a guide and precedent in dealing with others of a similar nature; for it seems to show that paracentesis may be safely practised under the protecting influence of antiseptic spray, when otherwise the operation might be deemed questionable, if not altogether inexpedient, and that it may thus curtail the exhaustive process of disease, which, if left to itself, a liver abscess entails, and save life that otherwise would have been lost.

On December 11th, 1879, I was asked by Dr. Anderson, of Maida Vale, to see a young officer, aged twenty-three, who had recently returned from India. I found him with well-marked symptoms of liver abscess, and much exhausted by a fatiguing journey from Bombay. There was increased hepatic dulness with enlargement, chiefly upwards, and bulging of the lower right side of the thorax; but the intercostal spaces were not then protruding. He was much depressed, in great pain, was slightly jaundiced, the tongue brown and coated, was unable to lie on either side, had nausea and cough, had lost all appetite, and was unable to sleep. There were occasional rigors and profuse night-sweats. The urine was high-coloured, full of lithates, not albuminous. The evacuations were scanty, frequent, and clay-coloured. He was much emaciated, and presented a miserably worn and cachectic appearance. From his history and actual condition it appeared to me that suppuration was approaching the surface upwards through the diaphragm and thoracic parietes, but did not demand immediate interference in his exhausted condition. I therefore recommended that he should be allowed to rest, be carefully nursed, and that the bowels should be regulated with bitter saline laxatives, quinine given, poultices and fomentations applied over the liver, and that sedatives sufficient to insure sleep and rest should be administered, that he should be fed on milk and light farinaceous diet, and a very moderate amount of stimulants given, and any change at once reported to me.

I saw him again on December 18th, and found the

symptoms of liver abscess more pronounced; the bulging of the side had increased, and there were slight œdema and obscure fluctuation in the seventh intercostal space between the mammary and axillary lines. The jaundice was perhaps slightly diminished, but other symptoms continued much the same. Rest and careful nursing had otherwise ameliorated his condition. I recommended that the abscess should be opened without delay; and as it seemed a favourable case for antiseptic treatment, I requested Professor Lister to perform the operation, which he most kindly did, in conjunction with Mr. R. Godlee, on December 19th. Under the influence of chloroform an incision was made through the most prominent part of the bulging of the intercostal space; it was deep, and gave rise to rather profuse hæmorrhage of dark blood, showing that vascular liver substance had been divided. This caused some anxiety for a moment or two, but bleeding soon ceased, and about twenty ounces of dark, blood-stained pus issued without any pressure, the spray being carefully directed on the wound meanwhile. The antiseptic gauze and bandages were then applied. He seemed much relieved by the operation, and expressed himself as feeling better than he had done for months.

The following notes of the history and progress of the disease, from its commencement up to the date of recovery, are by Dr. Anderson, now of H.M. Indian Medical Service:—

Case 1.

Summary of the Case of Lieutenant W., aged twenty-three and a half years; five years and two months in India.

"In November, 1878, when at Hyderabad, Scinde, Lieutenant W. suffered from a very severe attack of fever and hepatitis, necessitating his proceeding to Kurrachee for change of air. Soon after his arrival there the regiment was ordered on field service in Afghanistan, and as his health was in some measure restored he accompanied it. During

the cold weather he enjoyed fairly good health, but suffered whilst on the march from Jacobabad to Dadur from severe attacks of ague, with much gastric disturbance, on several occasions. In May last, at Dozan, in the Bolan Pass, having for some time previously undergone much fatigue and exposure to the sun, he had an attack of hepatic congestion followed by jaundice. This yielded to treatment, but left him very weak and anæmic. He was, however, gradually recovering strength, when he was again attacked (on September 19th) by acute hepatitis, accompanied by much prostration and total loss of appetite. He said he had had diarrhœa for eight months with traces of blood. The acute symptoms subsided under the administration of ammonium chloride and taraxacum with mustard poultices and hot fomentations to the side, but his strength was greatly reduced, and as the regiment was under orders to proceed to the Pishin at an early date, and Lieutenant W. was quite unfit to undergo the hardships and exposure of field service, he was sent on six months' leave to India.

"On October 3rd Lieutenant W. left Dozan, and arrived at Kurrachee on the 23rd of that month, travelling in rough carts all but the last day in rail. During his stay there, he had rigors, fever, and cold sweats. He went before a Medical Board on the 25th, and obtained sick leave to England for two years. Two days after he went by steamer to Bombay to await the departure of a troop-ship. In the hope of a change of climate effecting improvement, he left Bombay on November 8th, and after a very trying voyage, having had rigors and pains, he observed bulging in his side at Malta. He reached Portsmouth on December 8th. During the voyage he was under the care of a medical officer who administered quinine and nitro-muriatic acid, and ordered poultices, hot fomentations, and belladonna plasters, to allay the severe pain, but with little effect.

"Lieutenant W. arrived in London on December 9th, very feeble, and unable to walk. He was suffering from jaundice, and complained of very severe pain in his right side, which was constant, and prevented him from obtaining

rest. His appetite was gone, his tongue was furred and brown, his motions were clayey, and he suffered from profuse night sweats, with occasional rigors. To relieve the pain opium and bromide of potassium were administered freely, and poultices applied locally, but with only momentary benefit. On the 11th it was found that the hepatic dulness extended over a larger area of the chest than normal, and that there was considerable bulging of the right side just over the seat of pain. Recommended that he should be carefully watched, the poultices to be continued, as well as the sedative draughts; also that quinine be given every four hours, and the bowels kept open (with sulphate of magnesia). Between the 11th and 18th of December the same treatment was carried on; the night sweats and rigors increased; the temperature varied from normal to 101°; the pulse was rapid and feeble. On the 19th he recommended immediate steps to be taken for an operation.

"On the following morning Professor Lister, Sir J. Fayrer being present, assisted by Mr. Godlee, operated by making an incision about an inch and a half long in the intercostal space, and three inches external to the nipple, cutting straight down on the abscess. About twenty ounces of pus were removed, an india-rubber drainage-tube left in the wound, and over this a large dressing of antiseptic gauze.

"December 20th.—He has improved in every way; little or no pain; had a good night's rest, the first for many months. Appetite improved, tongue cleaner, no sweats, temperature and pulse normal. Dressing changed; gauze stained through to gutta-percha sheeting; no pus.

"21st.—Slept well; appetite ravenous, but food given with caution. Temperature and pulse normal. Dressing changed; discharge considerable, but still no pus.

"22nd.—No pain; can sleep on either side; motions natural; appetite good; dressing changed; discharge much less; no odour; temperature and pulse normal. For the next week the dressings were changed every other day, as the discharge decreased. On Christmas-day he was able to sit in an arm-chair for a couple of hours.

"January 3rd.—Doing well; has gained flesh; able to walk about. Dressing changed; only tinged with sanguineous discharge; drainage-tube shortened.

"7th.—Able to go downstairs; appetite very good; no trace of jaundice; tongue clean; dressing changed; no discharge; drainage-tube cut. After the 7th he had his side dressed only once a week; improved rapidly in strength, and on February 16th the drainage-tube was removed.

"From the date of the operation he has had no bad symptoms, with the exception of a slight attack of ague, for which five-grain doses of quinine were given with good effect. He has gained more than a stone and a half in weight during the last two months."

On March 9th he appeared before the Medical Board, the wound healed and his general health restored; but, considering his history, immediate return to India was not desirable.

This is a good example of the ordinary tropical abscess, due to climatic influence and exposure. The points of interest in the case are the position of the abscess and the direction upwards in which it pointed, the period at which it was opened, the results of antiseptic treatment, and the rapid recovery; the presence of jaundice is also noteworthy, that not being a common accompaniment of this form of abscess; and its rapid disappearance after evacuation of the matter, on pressure being removed. It is satisfactory when liver abscess comes to the surface *below* the *costal cartilages*, as there is less danger in opening it through the abdominal than the thoracic parietes. Adhesion may generally be assumed to have taken place, and danger of extravasation is avoided; but when it points upwards, there is more danger, especially when it takes place high up, lest there should be effusion into the cavity of the pleura, or possibly even danger of wounding the lower margin of the lung where it overlaps the liver, though it is probable that this would be consolidated with the pleura and diaphragm into one mass. In the case cited the incision must have passed very near, if not actually, through the margin of the lung. That liver tissue was divided was evident from the profuse hæmor-

rhage, which ceased, however, very quickly, seeming to show that it is not of much importance so long as there is no extravasation into the cavities. The rapid recovery seems to show that the abscess was single, and that cicatrization had occurred.

I have punctured liver abscesses, and washed out the cavity with solution of carbolic acid, with good results; but am convinced that the method adopted in this case is preferable, and that neither washing out the cavity nor pressure is needed. With antiseptic precautions there is little tendency to the formation of more pus, whilst the residuum finds exit through the drainage-tube; no local irritation is excited, and if the inflammatory condition which originally caused suppuration have passed away, a sanious discharge only follows, and repair may be expected gradually to go on. In the event of a second abscess forming the case would be complicated; but even then the prospects of recovery would be greater under the antiseptic treatment.*

The so-called tropical abscess of the liver appears to be a result of climatic causes, to which some constitutions are more prone than others; in certain instances, aggravated, no doubt, by injudicious eating and drinking, though it may happen in those who have observed the greatest moderation. Some individuals seem to be so susceptible as to be totally unable to tolerate the climate, and though perfectly healthy in temperate latitudes, become affected by liver-disease directly they return to India. I have been compelled, reluctantly, to invalid officers on this account, attempts to resume work in India, after recovery at home, having resulted in immediate recurrence of the disease.

Tropical abscess is generally single, but not invariably so, and though always a very dangerous disease, is less so than pyæmic liver abscess, which is multiple; for if the contents can be evacuated either by spontaneous or artificial

* An exhausting syringe has been constructed for me by Messrs. Wright, by which deep-seated collections of pus in the liver may be evacuated. A groove in the canula enables one to make a free opening, which is most desirable when the amount of liver substance is not too great to be divided with safety.

means, recovery is not only possible but probable, provided that the active condition of the disease which determined suppuration has ceased, and purulent infection has not taken place. It is a disease to which Europeans are more liable in India and China than in the West Indies or other tropical stations, and is a fertile source of invaliding and mortality, as you will gather from the following extracts from the Indian Army Sanitary Report:—

European troops in India, 1877.—Strength, 57,260; admissions for hepatitis, 2,490; invalids for change, 300; invalids for discharge, 22; deaths, 93.

For five years, 1871—1875, there were 1,868 men invalided from the Indian army, for hepatitis.

India, 1878.—Strength, 56,475; admissions for hepatitis, 2,461; deaths, 127; invalids for discharge, 34; invalids for change, 285.

I find in Bryden's "Vital Statistics," that of the British army in India up to 1876, for a period of six years, viz., 1871—1876, out of an aggregate of the average annual strength of European troops for that period:

Bengal	219,290
Bombay	63,279
Madras	67,451
Total	350,020

The average annual admission-rate for hepatitis per 1,000 on the six years was—

Bengal	49·7
Bombay	44·0
Madras	70·8

That the deaths during that period were—

Bengal	427
Bombay	124
Madras	218
Total	769

That the death-rate per 1,000 men was—

Bengal	1·95
Bombay	1·90
Madras	3·28

There were invalided—

Bengal	1,354
Bombay	337
Madras	538
Total	2,229

Or at the rate of, per 1,000—

Bengal	6·17
Bombay	5·33
Madras	7·98

This shows that the liability to death from hepatitis is much higher in Madras than in Bengal or Bombay, which are less tropical than the stations in Madras. The subjects of these statistics are for the most part young and healthy men. The European army in India is, in fact, a young one, only 2 per cent. being over forty-six years of age, and only 14 per cent. above thirty-five; 86 per cent. of the total are men below thirty-five years of age, 65 per cent. are under thirty, whilst the restrictions placed of late on sending young immature soldiers to India have resulted in this, that the returns for 1875 show only 1,264 lads under twenty, and those of 1876 only 1,185. The cases returned under hepatitis are not, of course, all of abscess; many, no doubt, are due to congestion or other disease, but it is probable that a large proportion of the fatal cases were due to suppurative hepatitis. Many of them, it may be presumed, terminated sooner or later either in death from continuance of disease, or recovery after getting rid of the abscess by spontaneous evacuation, or by surgical interference. The records of Netley and other large hospitals would supply evidence of the means available in this country for studying the course and termination of tropical hepatic abscess.

I am indebted to Surgeon-Major Don, A.M.D., for the following information respecting the relative frequency of

hepatitis and liver abscess in European soldiers in foreign stations:—

Year.	Strength.		Admitted.	Died.	Invalided.
		Bengal.			
1870	34,090	Hepatitis	1,920	152	249
1871	35,452	Hepatitis	1,919	5	241
1872	36,839	Hepatitis	1,814	3	210
		Abscess	98	55	43
		Ab. with dysent.	45	43	—
		Madras.			
1870	9,936	Hepatitis	635	41	131
1871	10,684	Hepatitis	713	41	58
1872	10,892	Hepatitis	586	5	70
		Abscess	43	35	—
		Bombay.			
1870	10,557	Hepatitis	424	11	49
1871	10,838	Hepatitis	464	18	30
1872	10,898	Hepatitis	350	12	41
		Abscess	12	8	—
		China.			
1870	546	Hepatitis	15	0	1
1871	516	Hepatitis	8	0	0
1872	789	Hepatitis	15	1	0
		Abscess	1	1	—
		Japan.			
1870	624	Hepatitis	15	1	1
1871	395	Hepatitis	6	1	0
1872	—	—	(No returns for this year.)		
		Straits.			
1870	571	Hepatitis	34	1	0
1871	571	Hepatitis	21	0	5
1872	708	Hepatitis	26	0	0
		Abscess	1	1	—
		Ceylon.			
1870	906	Hepatitis	37	5	10
1871	(Not given)	Hepatitis	44	1	10
1872	1,001	Hepatitis	40	5	2
		Mauritius.			
1870	665	Hepatitis	22	0	1
1871	(Not given)	Hepatitis	13	1	1
1872	469	Hepatitis	4	0	1

Year.	Strength.		Admitted.	Died.	Invalided.
		Cape and St. Helena.			
1870	2,441	Hepatitis	66	4	16
1871	2,473	Hepatitis	24	0	6
1872	2,484	Hepatitis	23	1	3
		West Indies.			
1870	1,432	Hepatitis	2	0	0
1871	966	Hepatitis	12	0	0
1872	1,112	Hepatitis	2	—	2
		Abscess	1	0	0
		Bermuda.			
1870	1,908	Hepatitis	8	0	1
1871	1,733	Hepatitis	6	0	2
1872	1,770	Hepatitis	5	0	0
		Canada.			
1870	4,519	Hepatitis	10	0	0
1871	2,383	Hepatitis	12	1	1
1872	1,602	Hepatitis	3	0	9
		Gibraltar.			
1870	4,397	Hepatitis	17	0	4
1871	4,428	Hepatitis	16	0	6
1872	4,066	Hepatitis	9	0	4
		Malta.			
1870	4,799	Hepatitis	26	5	6
1871	4,977	Hepatitis	26	2	7
1872	4,855	Hepatitis	27	0	4
		Abscess	2	1	0

From these returns it will be seen that the disease is more prevalent in India than in the West Indies.

It is thought by some that liver abscess is due to absorption of septic matter from dysenteric ulceration in the bowel; others have thought that liver abscess is the cause, and not the result, of dysentery. I am inclined to regard them as independent, though often co-existent, and due to the same climatic causes; and I believe that it occasionally does *result* secondarily by absorption from the ulcerated bowel, and is then of the nature of pyæmic suppuration, in which case it is apt to be multiple, and more serious in character than the ordinary form of abscess.

The early symptoms of suppuration in the liver are those of congestion, swelling, pain, high temperature, fever

preceded by chills or well-marked rigors, and sweats. There is cough, pain in the right shoulder and hypochondrium, inability to lie on the left side, owing to the weight of the swollen and dependent liver; nausea or vomiting, from pressure on the stomach, or irritation of the vagus; a yellow tinge of the skin and eyes; sometimes a high-coloured state of the urine and lithic deposits. There is a rise of temperature in the evening, but it is sometimes slight—100°, 101°, 102°—and night sweats, but often they are not excessive. These symptoms, together with the bulging of the side, between or below the ribs, leave little doubt of what has occurred. But there are cases in which the symptoms are less pronounced, and yet an abscess may form but escapes detection until bulging and fluctuation, or sudden evacuation of its contents through the bowels, the lung or stomach, or into the peritoneum, reveals the true state of matters. In the last case the result is generally fatal; in the former sudden exhaustion, amounting to collapse, may accompany a discharge of pus, or suffocation from effusion in the lung may prove fatal. The amount of pain depends on the part of the viscus implicated. If the matter be deep-seated in the parenchyma, at a distance from the peritoneum, the pain is comparatively slight or absent. If it approach the surface, or commence there, the pain may be severe. In any case there is a sense of distress and uneasiness felt most distinctly when the patient turns on his left side. Decubitus on *either* side is often painful.

In many cases of hepatitis, the patient is suffering also from malarial cachexia, and is liable to recurrences of febrile paroxysms which render it doubtful whether the chills or rigors and high temperature are due to this or to suppuration; where there has been no malarial fever, the chills or rigors may be so slight, or so mixed up with other uneasy sensations, as to have escaped notice, and the patient denies having had them at all.

Again, if the abscess be small and central or posterior, the pressure is so slight on surrounding parts that the stomach is not affected, neither is pain felt in the right shoulder, nor

uneasiness in the left side in the recumbent posture. In such cases the patients are apt to be regarded as suffering simply from general deterioration of health, disordered stomach and bowels, and congested liver from malarial cachexia, until the true nature of the case is revealed by the occurrence of the symptoms I have just described, or when, after death from diarrhœa, exhaustion, or other cause, it may be discovered that either an encysted and quiescent abscess still exists; or a certain amount of caseous matter in a contracted cavity shows that an abscess had formerly existed, but has undergone a process of drying up; or after years of broken health fresh inflammation may light up suppuration in or around an old abscess, and prove rapidly fatal.

The following cases will illustrate the subject under consideration:—

Case 2.

An English officer, aged twenty-nine, was exposed, on military duty, to the fierce July sun in the north-west of India during the greater part of an afternoon. This was followed by severe headache and general malaise. A few days later he felt severe pain in the right side, and was placed under treatment. Three days later, on the 16th, the pain increased, and he had fever; leeches were applied over the liver. In the evening he had a rigor. During the next few days the pain increased; he had more leeches, aperients and salines. The acute gave way to a diffused pain and weight in the hepatic region. Blisters were then applied. A swelling made its appearance four inches from the spine, below the ribs. He was then sent to Calcutta, where I saw him on September 4th. He was weak and anæmic, with a yellow tinge of the skin. The liver was enlarged, and just below the last rib there was a fluctuating swelling. Pulse 100; skin cool and moist; no pain, but uneasiness and a sense of fulness in the side; breathing slightly embarrassed. His tongue was clean; bowels rather costive; appetite fair. I opened the abscess, and drew off through a canula eighteen

ounces of thick dark-coloured pus; the cavity was washed out with a solution of carbolic acid, one drachm to a pint of water. The canula was left in the wound; the cavity yielded eight ounces of pus in the evening, and was again washed out with the carbolic acid and water.

September 6th.—Drew off eight ounces; removed canula, as it was causing irritation. There was no fever, and he was much relieved; the pulse less frequent. An aperient was given, as the bowels were confined. The wound was kept distended with a plug of lint soaked in glycerine and carbolic acid. Takes food and bitter beer with appetite. Quinine and sulphuric acid ordered; bowels to be kept open with sulphate of magnesia. Pulse 88; no fever.

8th.—Doing well, the quantity of pus daily diminishing; in the morning six ounces, evening two ounces. Eats and sleeps well; is in very good spirits.

9th.—Continued to improve. Two ounces of pus drawn off this morning; half an ounce in the evening. No fever. Pulse 78 to 84. Appetite good. The saline aperient to be repeated when bowels are confined.

10th.—Half an ounce of pus this morning; a quarter of an ounce in the evening. The cavity is evidently contracting. Pulse 74. He looks better.

11th.—Was fatigued by preparations for a sea voyage. Three-quarters of an ounce of pus in the morning; about one drachm in the evening. Pulse slightly quickened. He sailed this morning for England.

A report came from Ceylon that he was well enough to go on shore for a walk.

This is a good example of simple abscess of the liver in a young man of steady and regular habits. There was no history of dysentery or diarrhœa; it apparently commenced by congestion, terminating rather insidiously, as so frequently happens, in suppuration, which probably commenced about twelve days after the first symptoms of congestion. As inflammation approached the surface, the pain increased, and peri-hepatitis caused adhesion of the right lobe to the parietes. There was reason to believe that the abscess was

solitary, and not due to septic absorption from dysenteric ulceration. The prognosis was favourable, as latterly the abscess had caused little constitutional disturbance. The rapid contraction of the cavity showed that repair was vigorous. Recovery proceeded rapidly under the influence of change of climate and sea air.

The following case shows the insidious manner in which liver abscess sometimes forms :—

Case 3.

A young Englishman, aged about twenty-one, of fair complexion and healthy, vigorous frame, of rather irregular habits, after a residence of three years in Bengal, complained of anorexia, hepatic fulness, general sense of failing health, disordered bowels, sometimes confined, sometimes relaxed; tongue loaded. He was anæmic, and the skin had a yellow tinge; tongue coated; pulse quickened. There had been neither rigors, chills, cough, nausea, nor vomiting. The liver was enlarged downwards, but there was no bulging, neither much tenderness on pressure. Saline aperients, to relieve the portal congestion, were ordered, and he was sent to sea for change of air; returned in a few days, and went to reside a short distance from Calcutta, continuing to perform his official duties.

When I saw him some weeks later he looked pale and thin, but was in good spirits, and at his work as usual; indeed he had not been absent more than a day or two. Though still weak, he was rapidly regaining strength. He informed me that one day, soon after his return from on board ship, after dining with some friends, one of them, in romping, accidentally gave him a squeeze by bending his body, which compressed his side. This was followed immediately by symptoms of collapse, with coughing and vomiting of a large quantity —a basinful—of purulent matter. A liver abscess had opened into the stomach, and evacuated. On recovering from the shock, he soon began to regain strength, and before very long was restored to health.

This case shows how insidiously the liver may suppurate without more marked symptoms than may be seen in cases of malarious poisoning, in which the general deterioration of health is expressed by occasional feverish attacks, attended by some hepatic congestion; the first evidence of the formation of matter being its sudden evacuation in the manner described. On the other hand, the most characteristic indications may have been present, including rigors, chills, high temperature, sweats, vomiting, with hepatic swelling and pain, and subside without any evidence that pus has formed; indicating acute congestion, which has resolved, or that an abscess may have formed and been removed by absorption, or have opened into the intestine, and passed away so gradually as to be unobserved by the patient, who has regarded it as a phase of diarrhœa, from which he was already suffering. In fact, the diagnosis of liver abscess often escapes detection by the most acute observers.

Another case is that of an English officer, aged forty-two, of slight frame, but previously in good health, who had been in India several years, and returned to England suffering from symptoms of hepatic disease.

Case 4.

"Colonel R. B. went to India in December, 1868. Since that time has spent twenty-one months in England. Returned to India in July, 1874. Up to this his health had been good. In the beginning of February, 1877, when at Mhow, he began to be ill. Pain, sometimes severe, on the left side of the back of the head; his skin became yellow; he was feverish, his spleen was enlarged, and the left side bulged; this was blistered and soon subsided. The pain in the head continued; he lost flesh, and seemed weak and ill. On February 27th he embarked for England. In Bombay he got worse, and on the voyage to Port Said was very ill—restless nights, intense weakness, loss of appetite, hands tremulous, shivering fits, and night sweats. He arrived

in England on April 2nd. He had had excellent health in India previously, and led a most active and very temperate life. He was at Delhi in December and January, in tents. Very hot days, very cold at nights. He used to be out all day, but was very careful in protecting his head from the sun. It was not until a fortnight after his return to Mhow that he began to complain of pain in the head—the commencement of this illness."

I found that the liver was enlarged downwards; his skin was tinged with bile, his face pinched and anxious, his urine occasionally loaded with lithates, bowels constipated; pulse from 100 to 120 and 130, very easily excited; great debility and nervous depression; walks in a stooping attitude and looks feeble; slight tenderness on pressure over the lower margin of the liver, no pain nor enlargement of the spleen; other organs apparently normal. The morning temperature was 100° to 101°, but rose in the afternoon to 102° and 103°. The general aspect was that of one suffering from hepatic suppuration.

I watched this case with much interest for several weeks, during which the progress was slow but satisfactory. There was gradual return of strength, less nervous depression, improvement in the condition of the urine and secretions, and a steady decline of temperature from 103° to 100°, and 99° to 98°, especially when he was under the influence of five-grain doses of quinine and hydrochlorate of ammonia, a valuable remedy, for the use of which in liver disease we are indebted to Dr. Stewart, B.M.S., taken three times a day. Pulse gained force, slower and less irritable; appetite, spirits, and the general aspect of convalescence gradually increasing.* It is impossible to say whether suppuration had taken place or not. A small abscess may have formed, that either had become quiescent and was gradually drying up, or may still

* As I write, March 30th, 1880, he has come in to see me, having just returned from India. He looks in excellent health. Has had no liver trouble. Has recently suffered from renal calculus. Urine now healthy, except that it is rather phosphatic. It is interesting to note the occurrence of this calculus in reference to the damaged liver.

some day empty itself through the bowels, if it had not already done so unobserved.

The thermometer is, perhaps, the best indicator of the changes going on in the liver, and the absence of other marked symptoms makes it difficult to form a diagnosis. One can only wait and watch the tide of daily temperature, pulse, and the state of the excretions. The continued depression of health, and the persistence of high temperature in such cases, especially if accompanied by chills and sweating, even though slight, point to suppuration; and it must be remembered that pus *may* become encysted, quiescent, and so localized as to have little or no apparent disturbing effect on the general health, and yet such a condition is fraught with danger from any accession of inflammation in the cavity or its vicinity, and the consequent increase of the primary abscess, or the development of new ones. Hence the importance of great care on the part of those who have suspected liver abscess, and the danger of exposure to any cause, climatic or dietetic, that might tend to set up fresh mischief.

Case 5.

M. D., aged twenty-three, came under my observation in Calcutta in April, 1867. He had been in Calcutta for about three years, had enjoyed good health until recently, and was neither intemperate nor irregular in his habits. On March 4th he had had ordinary fever, but when I saw him in April, though there had been no great amount of pain, there were well-marked indications of the formation of pus, but neither jaundice nor diarrhœa. The liver was enlarged downwards, and a prominence below the ribs was evidently due to an abscess. On April 19th I introduced a trocar and canula, and gave exit to a large quantity of pus. The cavity was washed out with a weak carbolic solution, the canula was left in, that more pus might be drawn off at intervals. He was much relieved, and soon improved. But to better his chances of recovery, and to get him away out of

the intense heat of April in Calcutta, he was put on board a steamer, with the canula still in the wound. He improved so much on the way home that it was removed before he reached Suez—"in about fourteen days." Within three months he had recovered, and ten years later I saw him in good health. He returned to India, and is, I believe, still there.

Case 6.

In 1866, when at Agra, I saw a young officer in camp, who, after considerable exposure to heat and fatigue during hot days and cold nights, was suffering from what was thought to be pneumonia of the right lung. On examination it appeared to me that he was suffering from pneumonia, but that it was due to liver abscess which had formed insidiously, and made its way into the right lung. I did not see him again for three weeks, when he came to Calcutta. He was fearfully emaciated and hectic, with a very rapid pulse and diarrhœa. He was expectorating large quantities of pus, by which the right lung seemed to be completely overwhelmed. He appeared to be rapidly sinking, and was in an extreme state of prostration. A few days later he was put on board a steamer, in the hope, though it seemed a feeble one, that change of climate and sea air might do him good. On arrival at Galle he was so low that it was decided to land him. A message, describing his condition, was sent to his friends. I heard nothing more of him for four or five months, when he came to report his return to India. They had put him on board another steamer, and he had gone to Singapore. Soon after landing at Galle he began to revive a little; the expectoration diminished, and feeling stronger, he was determined to try the sea air again; he embarked, soon improved, and became strong enough to walk about. He rapidly regained strength, even in the tepid climate of the Straits, and when he returned to Calcutta was apparently well, and I believe soon resumed his duties. I saw him again a few years ago stout and well; he told me

that his life had been accepted at the usual Indian rates by an insurance office.

In this case there was probably only one abscess, although a very large one. I never saw anyone apparently so near death recover. His lung regained its normal condition, and did not suffer permanently from the suppuration in which it had been involved.

Such a termination could not generally be expected in so severe a case; I relate it to show that even where a very large abscess has opened into the lung, recovery is possible.

Case 7

Is the case of a native of India in whom I punctured an abscess between the ribs behind the axillary line, and gave exit to the contents of a very large abscess. On seeing him again after some days, with his medical adviser, I found a large sloughing opening and a considerable portion of one or two ribs necrosed; repair, however, seemed to be progressing, and the condition, barring the aperture in his side and the diseased ribs, rather better than it had been. When I saw him next it was on the steps of the hospital, where he had come to see some friend, and on inquiring I found that the wound had closed. There was a deep cicatrix over the exfoliated ribs, but otherwise it had healed well. He was stout and in perfect health. I refer to this case as an exceptional one, for I have generally found where the ribs necrose and the opening becomes large from ulceration or sloughing, that the patient succumbs at last to exhaustion, if not to some other complication; when an abscess points between the ribs, especially towards the back, it is exceedingly prone to cause necrosis, if punctured; the earlier the operation is done the better.

Case 8.

Mr. P., aged twenty-five, a tall, vigorous young officer of cavalry, came to me on March 19th, 1880. He went to

India first in January, 1876, to Bangalore; was quite well for a year. Then got jungle fever, shooting in the Annamallay jungles, Mysore. This lasted for three weeks, and he lost two stone of weight. He continued to have recurrences of malarious fever once a week for the next two years, but remained at duty, and occasionally went out shooting. He then went to the Pulni hills, and before and after his return had dysentery, with great pain. This was aggravated by attending riding-school. When convalescent, pain in the liver commenced. He became very ill, and says he nearly died from a severe attack of dysentery. He was actively treated, and got much better. In July, 1878, the dysentery had gone, but he had diarrhœa, and for twenty weeks he could hardly walk; had lost three stone. Diarrhœa continued, and with it pain in the side, but he began to regain strength.

He then came home. In the winter of 1878, when at his home in Yorkshire, he began suddenly to spit blood and "thick stuff," especially when he "stooped," when, as he says, it welled out in quantities, a tumblerful at a time. This went on till August, 1879, yet all the time he seems to have been leading his usual life—riding, even hunting, shooting, "one turnip field at a time," as he says. He seems also to have been gaining strength. Still had pain, but less since the blood and matter came away.

On December 2nd, 1879, he returned to Bangalore, feeling pretty well. Cough and expectoration had ceased, but he was weak and knocked up by any physical or mental effort, depressed, and irritable. Three days after reaching Bangalore, diarrhœa and pain in the side came on again. Dysenteric symptoms also supervened in January, 1880; got worse at riding-school, and had great pain in the liver.

He was sent home again in February, 1880. "He improved on the voyage, and is now fairly well. Has had no cough since August last; weight twelve stone; looks in good condition; conjunctiva rather yellow; complexion rather florid; hepatic dulness increased posteriorly, not in

front; no sign of thickening of colon; no enlargement of spleen; respiration not so good on right as on left side, but expansion normal; urine contains lithates at times, no albumen; tongue clean; temperature and pulse normal; bowels rather confined; eats well, but is easily tired; has resigned his commission. He has evidently been the subject of liver abscess, which has opened through his lung."

Case 9.

Captain S. C., aged thirty-seven years and six months, of abstemious habits. Service in India sixteen years and four months: in Bombay presidency—Poona, Surat, Rajpoora, Ahmedabad, Deesa, Ahmednugger, Sholapore, Baroda, Satara. In Goojerat had fever and cholera, the only sickness since infancy, up to present liver attack. Came home in 1863 with very severe Goojerat fever; the attack was most persistent; "lost his hair, nails, and epidermis." Returned in 1865 quite well; has had no return of fever since.

July, 1875.—At Satara, Bombay, suffered pain in back and side, with some nausea and fever. Disease yielded to treatment in a few weeks.

July, 1876.—Again attacked with above symptoms in intensified form, with rigors and night sweatings. The frequency of the attacks increased until March, 1877, when he was quite prostrated, and confined to bed.

April 9th, 1877.—An unusually sharp attack, accompanied by severe rigors and some fever, leaving him in an unconscious state.

21st.—Left for Bombay. Suffered severely from the journey.

May 7th.—Put on board a steamship for England.

27th.—During the night, while at the water-closet, he experienced severe rigors and passed large quantities of blood and matter, became insensible, and was carried to his bed.

June 5th.—From last severe attack on May 27th his health appeared much improved. On this date, at Southampton, he experienced another, though perhaps a little less severe, attack; passed much matter and blood.

As soon as able he left for London, and put himself under Dr. Murchison's care, who greatly interested himself in the case until his death.

He could not account for this disease. Is of abstemious habits, never taking spirits or wine between meals. Is married, of active habits, and very fond of field sports, which fully occupied his leisure. Is now in fair health.

Case 10.

Surgeon E. S. R. Service in India fourteen months and seven days—Calcutta, five months; Meerut, seven months; Jumrood, Kohat, Thull, the remainder. Had scarlatina as a boy; nothing else except a fortnight's intermittent fever at Jumrood, before the liver became affected. On the 7th of November, 1878, while at Kohat, felt pain in the right shoulder. On November 8th he started for Thull with pain in the shoulder and hepatic region. On arrival there he was suffering from acute hepatitis; he remained under treatment in the camp until December 4th; then returned to Kohat, when the liver was enlarged, especially upwards, with tenderness on pressure. The temperature in the evening was from 102° to 103°; morning 100°. Did not feel much pain in the liver, except in the middle of December for a few days. On December 31st, having been ordered to England, he left Kohat, and got to Peshawur on January 1st, 1879. Left Peshawur for Rawul Pindi on January 1st, and arrived there on the morning of the 2nd. That same evening, about nine o'clock, while in bed, there was a rush of matter into the mouth, from an abscess in the liver, which had opened into the right lung. There was no previous warning of this, and he did not feel any pain, only extreme weakness. About a pint of pus was discharged that

night, and also the next; but after the first two nights pus was not discharged in any quantity. Started from Bombay on January 20th, and reached England on February 17th. Pus continued to be discharged for the whole of this period, and up to three weeks after his arrival. About a month after the cessation of the discharge of pus, bile in considerable quantity was discharged into the right lung. This went on for about ten days. After that he rapidly improved, and about the end of the first week in May he first got out of bed, and was able to sit up. Convalescence then proceeded rapidly without any relapse. Appeared before the Board on Tuesday, March 23rd, 1880, apparently well; but not allowed to return to India yet.

Case 11.

A case of abscess of the liver, following dysentery, discharging itself through the right lung; recovery; patient invalided to Europe; return to India; supposed return of abscess, and second return to Europe.

A. B., aged thirty-three, a surgeon in the Indian service, who had previously been in good health, was attacked with acute dysentery in July, 1875, which yielded to change of air; five weeks after, owing to exposure to wet, sun, and fatigue, symptoms, which terminated after fourteen days in the discharge of an hepatic abscess, made their appearance. For the first few days, lassitude, anorexia, and nausea were alone noticed, followed soon after by pain over the hepatic region. The pain, at first present during movement, and with a deep inspiration, soon became permanent and of a severe burning character, though not materially affected by pressure, and was associated later on with pain in the right shoulder, with the advent of which the temperature ran up from 102° to 103° in the morning and 104° in the evening, probably being coincident and due to the spread of the disease towards the diaphragm and the occurrence of

pneumonia. For five or six days before the discharge of the abscess, the sense of collapse and suffocation, attended with orthopnœa, became intense, and a pustular eruption appeared, each pustule ranging in size from a pea to half a pea. The only physical signs noted were dulness on percussion and crepitation. There could not have been much liver enlargement, as the disease was only detected on the discharge of the abscess, the symptoms having been put down to pneumonia. There was not much jaundice; bowels confined, and stools of ochre colour.

Aconite was given early. It produced copious diaphoresis, but failed to reduce the temperature or give relief.

An abscess burst during the night, and about one pint of thick, flocculent, puriform fluid was coughed up at one gulp. It continued to discharge during a few days, but all the symptoms gradually disappeared, and the patient left India, after about two months, for Europe. He did well till he arrived at Suez, when, owing to the cold land-winds in the month of December, he was attacked with liver congestion and pleuritis, which put his life in jeopardy for six weeks. He remained in Europe one year, during which time he had six attacks of congestion; the "catch" in the side hardly ever left him. He returned to India in indifferent health, and, after several minor attacks, he finally broke down after a year and four months, and was invalided from the effects of what his medical attendant believed to be an abscess, which either became absorbed, or passed away by the bowel. The patient himself considers this to have only been a prolonged and severe attack of hepatic congestion, or inflammation, without suppuration. It is right to say that the medical man held a different view, and it may have passed through the bowel unnoticed, as there was diarrhœa at the time.

He returned to Europe, and is now, after two years in this country, fairly well. But the "catch" in the side returns with each attack of congestion, and remains for some time. There is always a heavy, uneasy feeling about the liver, which is increased to actual pain after much fatigue.

This, with nausea in the morning, bad appetite, a cracked tongue and inability to work, still remain

As to treatment generally. In the outset it is that of acute congestion; in the hope of preventing suppuration, leeches on the side or anus occasionally may be beneficial. Where the symptoms are acute, the pain great, and the fever high, free purgation by saline aperients, occasional mercurials, chloride of ammonium or ipecacuanha, hot fomentations over the liver, rest, and a light unstimulating diet are required so long as the acute symptoms continue, before suppuration has taken place. It is needless to say that the mercurials are not used with the intention of producing ptyalism. When there is reason to believe that matter has formed, although the physical signs of it may not be clear, attention should be directed carefully to the evacuations, especially if there be diarrhœa, as the abscess may open into the bowel. I think this is the probable explanation of recovery in some cases where it has been thought that the abscess had either never really formed or that it had undergone absorption. When opening occurs through the lung or stomach the symptoms are unmistakable.

When abscess has formed the object is to favour its evacuation, to support the strength, and to allay irritation. When sufficiently near the surface to justify puncture, it should be opened antiseptically. Much has been written and said about exploring for liver abscess, and in certain cases, where doubt exists, I think the proceeding is justifiable, using a small canula and aspirator when there is enlargement, tenderness on pressure, which causes nausea and disturbance of the heart's action, such as palpitation or sickness, especially if there have been any chills, increase of temperature, or sweats. In the event of matter being detected at a considerable depth, it may in some cases be aspirated, but it may happen that, on account of its thickness and the presence of flakes of lymph, pus will not pass through the small canula, and no satisfactory result is obtained; but if there be any marked probability of its presence, a larger

canula should be used and left in after if pus is found, or the opening may be enlarged and a drainage-tube introduced, the most careful antiseptic precautions being observed in the subsequent dressings. Whenever the matter lies moderately near the surface, even though a certain amount of liver tissue intervene, I am inclined to think that a free incision and a drainage-tube is best—hæmorrhage, should it occur, soon ceases, and there is much better prospect of a free drain afterwards. A large canula may in some cases be preferable; indeed I think it would signify little which were selected, provided antiseptic precautions be carefully observed and the drainage be free. In the event of exploration detecting matter deep seated, but through much liver substance, I should prefer the canula, used with the aspirator, but great care should be taken not to exhaust too rapidly, or with too great force, for fear of injuring the liver tissue surrounding the cavity of the abscess and causing hæmorrhage. The treatment after the opening of an abscess is just that which is described in Dr. Anderson's case. Support the strength, and try to obviate any decomposition in the cavity, or extension of the mischief.

Dr. W. S. Palmer, of Calcutta, makes the following remarks on the subject of puncture. His large experience renders them interesting:—

"You have asked me to give a brief account of the results of treatment by puncture in cases of doubtful liver abscess which came under my treatment during the period of six years, in which I had medical charge of an average of about seventy patients in the European General Hospital, Calcutta.

"Passing over cases of undoubted liver abscess, there was still a residuum of patients presenting doubtful symptoms, in whom neither unsymmetrical enlargement nor superficial tumescence, etc., could be detected. Such patients presented symptoms varying in every degree; at the one, extreme cases of general cachexia, with irregular slight febrile attacks, would exhibit symptoms as frequently attributable to deranged stomach, or bowels, or lungs only,

as to the liver itself; while at the other, slight general enlargement of the organ would be found associated with that peculiar form of 'tenderness' in which pressure over the organ produced an indescribable sensation, inducing either faintness, hurried respiration, palpitation, or nausea, with retching, or all of these at once.

"In all this large class of cases it was my custom to plunge a long trocar and canula, of small diameter, into any or all parts of the liver, through a valvular opening, examining on the spot the small quantity of extracted matter for pus globules.

"It was only in very exceptional cases that any signs of pus could be detected. When it was so detected the puncture was generally followed by slight inflammatory action at its seat, which probably ended in adhesion of the organ to the parietes, and so facilitated the future opening of the abscess. When, on the other hand, no pus was found, a good deal of anxiety was felt in the earlier cases, lest the puncture should be followed by any evil results. Such moments of anxiety soon, however, ceased to recur, for it very rarely happened that the patient did not express himself the next day as feeling very much relieved; and in no case do I remember any bad consequences resulting from such punctures. The relief was frequently only temporary, in which case a second, a third, or a fourth puncture was made at intervals of eight or ten days. In some, however, one puncture sufficed to cure."

As to the period when an abscess should be opened, it is whenever the symptoms give assurance that matter has formed, and that the operative proceedings necessary to reach it are not themselves so dangerous as to be prohibitory.

The points at which an abscess may be opened are, in the epigastrium, anywhere in the right hypochondrium either in front or behind, between the costal cartilages, or ribs. Puncture below the ribs is to be preferred, if possible, but it is not always so; and, as in Mr. W.'s case, it is necessary to perforate between them.

The dangers of mischief to the pleura or lung, and of

necrosis of the ribs, are the causes of anxiety in operating through the thorax, but these untoward results may never occur. In any case the opening of a liver abscess is a critical proceeding, but it should be resorted to whenever there is a reasonable prospect of getting at the pus, for it is very desirable to anticipate spontaneous opening by any of the channels that nature may select, as all are dangerous; when into the peritoneum, pleura, or pericardium it is of necessity almost always fatal, while even into the lung, stomach, or bowel, the danger is often great, and though followed by temporary amelioration, may end in exhaustive disease or purulent contamination of the whole system.

ON THE MALARIAL SPLENIC CACHEXIA OF TROPICAL CLIMATES.

(*"Medical Times and Gazette" of January 3rd*, 1874.)

A NOT unfrequent result of protracted exposure to the influences of malarious climates, like those of Lower Bengal, Assam, Cachar, the Terai, and, indeed, many other parts of India and the tropics, may be observed in the anæmia and enfeebled condition of the general health, which is commonly attributed by the sufferers themselves to "spleen," and technically is described as splenic cachexia.

The actual part taken by that important vascular gland—the spleen—in elaborating and perfecting the blood for the purposes of nutrition, is not yet fully known in all its bearings, though the researches of Gray, Bennett, Kölliker, and many other physiologists have thrown much light on the subject, and seem to show that, although it may not be absolutely essential to the continuance of adult life, yet is physiologically of the greatest importance in the economy, at all ages, in reference to the quantity and quality of the blood. What physiological experiment and research have indicated, pathology appears to confirm, as may be observed in the blood-dyscrasia and impaired nutrition invariably present in those suffering from malarious affections of the spleen. It is probable that in such cases the blood is the first in order affected, whilst in many there is some hepatic complication, the splenic change being a consequent result. There is every reason to believe that when the spleen has become so implicated, it is incapable not only of duly performing that part in the elaboration of

the blood which is essential to perfect sanguification, but that it is an abiding pathological source of blood-dyscrasia —which, if not removed, may result in the gravest evils. This certainly is the case in elephantoid growths, for, whilst they remain, the subjects of them are ever liable to recurrences of paroxysmal fever and exacerbations of the growth of the tumour. Removal of the morbid tissue, which may often be effected by surgical operation, is followed by removal of the constitutional disorder. The tendency of the poisoned blood and of the disordered spleen in malarious poisoning to react prejudicially on each other is, in like manner, to increase.

It is very desirable that further chemical and microscopical examination should be made, not only of the blood during life, but of the connective tissue, spleen pulp, corpuscles, and blood, when opportunity occurs, as it frequently does in India, after death.

The determining cause of this form of cachexia is malaria, that is to say, something that operates under certain conditions of heat and moisture, combined with unknown telluric or atmospheric influences, in the presence generally of organic, vegetable matter in a state of decay. Whether this be a subtle gaseous emanation, or whether it pertains rather to the realm of the imponderables, I cannot say: it is best known by its results; and this poisoning of the blood and consequent or concomitant affection of the spleen and accompanying cachexia is one of the most frequent modes in which it expresses its action on the human frame.

Malarious enlargement of the spleen, and the attendant or consequent cachexia, are frequently, but by no means constantly, the results of repeated recurrences of malarious periodic or remittent fever in those long exposed to such influences; and when the patient has previously suffered from ague it is to be expected that, whilst the spleen remains affected, so long will the person be liable to recurrence of paroxysms of fever. These, however, are not by any means the most serious or obstinate cases of splenic cachexia; on

the contrary, they are often more tractable and amenable to remedial measures than others apparently of a less formidable though more chronic nature, which not unfrequently present themselves in a marked form where no fever has previously occurred.

Under proper treatment, or by change of climate, the spleen in any case frequently rapidly decreases in size, the paroxysms of fever become less frequent and severe, and the cachexia and leukæmia gradually disappear. I have seen Europeans, and natives, too, in India, who had gradually failed in health, become feeble, anæmic, with pallid lips and conjunctivæ, pearly sclerotics, œdematous limbs, albuminuria, and other symptoms of disordered spleen, with all the indications of malarious poisoning prominently marked, who had never had a single attack of fever or neuralgia, and who were unconscious that they were suffering from malarious poisoning. This slow and insidious undermining of the health is not uncommon in many parts of India, and it contributes its share to the numbers who are yearly sent away broken down in health by the effects of climate.

In a large proportion of such cases the liver as well as the spleen is involved, and it is sometimes difficult to say what share in the disease should be assigned to each. The vascular connection through the portal circulation, and the inter-dependency of these two important organs, is so intimate, that it is hardly possible one should suffer without the other, from causes which are naturally so prejudicial to both; but as in many cases the hepatic complication is so much less marked than the splenic, I confine my remarks at present to the latter form of the disease.

Malarious enlargement of the spleen is seen in all stages, from the slight and transient engorgement that accompanies or follows an attack of intermittent fever, to the permanent hypertrophy or congestion that results from many such attacks, or from malarial poisoning without fever. One form of it, when ague was frequent, was not very uncommon in some parts of England, and was known as

"ague cake." In this the spleen was enlarged and indurated, its lower margin in some cases hard and well defined, extending even as low as the iliac region. It did, in fact, assume various conditions and degrees of density or size, in some being hard and painful, clearly distinguishable by palpation and percussion below the ribs in the left hypochondrium; in others, it was soft and almost diffluent—perhaps with little pain—like a sac of fluid, forming a tumour more or less extensive in that site, and prone to rupture from external violence, or, as some say, spontaneously—such is not a very unfrequent cause of sudden death among the natives of Bengal from slight injuries or accidents. On the other hand, in some cases the cachectic condition is well marked, though there may be little or no physical signs of increase in bulk of the spleen, though no doubt, could the organ be more completely examined, some enlargement would be found; and it must be admitted that the extent of cachexia is not always a measure of the hypertrophy of the spleen. I do not use the term splenitis, as it would be—here, at least,—a misnomer. The spleen, however much it may be pathologically changed, is not generally inflamed. The capsule, indeed, may be, or have been, the seat of inflammation, and other morbid changes may occur.

The pathological changes that take place in the spleen, whether of enlargement, contraction, induration, softening, or degeneration—albuminoid, fatty, or otherwise—as a result of malarious poisoning, require further investigation. The microscope might reveal changes of importance in the hypertrophied and indurated connective tissue entering into the composition of its capsule and trabeculæ. The inter-cellular spaces altered, perhaps being diminished or contracted if inflammatory action or irritation have previously occurred, many changes may result from the presence of inflammatory products; and when the organ has been distended and softened, opposite conditions would probably be found.

Important changes no doubt take place in the Malpighian

corpuscles, and parenchyma or pulp, whilst the arteries and veins, especially the latter, and the venous cavities are probably dilated. The blood itself is rendered unfitted for the purposes of perfect nutrition, its most important defects, perhaps, being those of the relative quantity and quality of the corpuscles, as seen in the leukæmic and anæmic state of the patient, in increased proneness to deposit fibrinous coagula, and in the great tendency in many cases to death, gangrene, or extreme degeneration in the imperfectly nourished tissues, resulting from embolism in either the pulmonary or systemic circulation.

In chronic cases other degenerative changes of an adipose or albuminoid character might be expected, and, where embolism of the splenic vessels has occurred, local deaths or disintegration of portions of the spleen substance, resulting in puriform collections round the starved portions of tissue. But abscess as a direct result of inflammation is, I imagine, comparatively rare.

As I have already said, many of the cases one meets with in India occur in those who, either after repeated recurrences of fever, neuralgia, or other marked expression of the influence of malaria, gradually lose their health, and pass into a state of cachexia, with enlarged spleen. But there are cases where the person has resided for a long time in a malarious district, and undergone much exposure, in which the cachexia comes insidiously on without any marked premonitory evidence of malarious poisoning. There is gradual loss of health, the appetite fails, the spirits are depressed, energy is diminished or lost; the skin becomes sallow or pallid and harsh; the mucous membranes, the conjunctivæ, and the gums and lips become blanched and bloodless; the tongue white and furred; the bowels irregular, often with diarrhœa; the palms of the hands and feet are hot, the limbs and body ache, and are wearied with little or no exertion, whilst there are occasional feverish or neuralgic attacks. There is indisposition and incapacity for work or exertion of any kind, hurried respiration, and the patient is not free from danger of embolism due to the tendency

to sudden separation of fibrine in the circulating blood; pain in the hypochondriac regions, and probably œdema of the lower extremities or the face and eyelids now begins to appear. Occasionally there is general anasarca, or even ascites, and in some cases hæmorrhage from the gastro-intestinal mucous membranes; in some cases there is albuminuria. The blood is watery, spanæmic, and no longer nourishes the tissues properly, as may be seen in the enfeebled body, the enervated mental powers, whilst systolic aortic murmurs point to its altered condition, or to pressure on the heart by the hypertrophied spleen. It is remarkable, too, that persons so affected, though they may not have previously had ague, are often surprised by having a severe attack on going to sea or on changing the climate.

The symptoms I have just described represent what may be regarded as the still remediable conditions of splenic cachexia; but in those who are not removed from the evil influences, matters soon assume a more serious aspect, and it is noteworthy that in children and young people the severe and dangerous symptoms seem to supervene more rapidly than in those more advanced in life,—as seen in the greater tendency of children to cancrum oris, noma, sloughing of soft parts, or necrosis of the bones, hæmorrhages from the stomach or bowels, serous effusions into the cavities, and general anasarca,—evidently because in early life the well-being of the individual is more dependent on the action of the spleen, in elaborating the blood for the purposes of nutrition and growth, than in later life, and, consequently, that interference with its functions at this period is of more serious import than to those of more mature age. As a general rule, if the mischief have not proceeded beyond the stages already described, recovery is pretty certain to follow if the individual be removed, from the place in which he has suffered, to a more healthy and invigorating climate, and if he be subjected to proper treatment. The importance of change of climate it would be difficult to over-estimate, not only on account of the present evils of his condition,

but because of the prospective danger, should he become the subject of other disease, wound, or accident. An attack of dysentery would be extremely dangerous; parturition or a wound not less so; whilst surgical operations, excepting such as may be urgently needed to save life, are so dangerous, that they should be altogether declined.

I have elsewhere called attention to the dangers that are liable to occur after surgical operations in the anæmic inhabitants of malarious climates, pointing out that although individuals so situated may not be regarded as the subjects of marked malarious poisoning, yet that all are probably more or less affected; and that it is my impression that a condition of the blood is thereby induced, which has much to say to the marked tendency evinced by such persons to suffer after surgical operations, wounds, accidents, and during disease, from paroxysmal fever, and even from embolism or cardiac coagula.

The mere passing of a catheter in a comparatively healthy man has been followed by paroxysms of fever and deposits of fibrine in the pulmonary artery, which have proved rapidly fatal. The slightest wounds have, in those more deeply affected, been followed either by gangrene or by hæmorrhage —the abstraction of a tooth, by necrosis of the jaw, a pimple on the face, by gangrene of the cheek, or the sting of a wasp, by gangrene of a limb,—all proving the low vitality and tendency to disintegration of the tissues in this diseased condition. A visit to a Calcutta hospital would frequently afford evidence of the effects of splenic cachexia, in the gangrenous stumps resulting from arterial embolism, in bad cases of cancrum oris, sloughing of other parts, in necrosed maxillæ, or in the severe attacks of fever and pulmonary embolism that have followed wounds and surgical operations, or have occurred in cases of disease.

But it is not so much of these aggravated forms that I now wish to speak, as of those of a less marked and more common nature in which it presents itself, not only in those who remain in the localities where it has originated, but also in some who have returned to Europe,—and especially

with a view of suggesting how it may be dealt with hygienically and therapeutically.

The most important element in the treatment is removal from the evil influences of the place in which it has commenced. The more complete the change the better for the patient; and, as a general rule, it is desirable that it should be to another and more bracing climate—extra-tropical and remote from malarial influences. When the disease has not advanced very far, a sea-voyage and absence for a short period—three months or thereabouts—might suffice; but in more advanced cases change to Europe is necessary. As to drugs, quinine and iron are especially indicated, and a combination of the alkaloid with sulphate of iron is probably the best. But any of the preparations of iron, such as the perchloride or the citrate of quinine and iron, will suffice, if preferred. When there is tenderness as well as induration of the swollen spleen, and also when there is hepatic pain and congestion, and, indeed, even when this latter complication does not exist, hot fomentations, sinapisms, or tincture of iodine may be applied. Some saline aperient, sufficient to produce a tolerably free drain from the portal system, is often desirable. A combination of either the sulphate of magnesia or soda, with or without iron and quinine, in somè bitter infusion, taken in sufficient quantities early in the morning to induce one or two fluid motions, is best. It is needless to say that all depleting or exhaustive remedies, such as blood-letting, excessive purgation, or mercury, are entirely inadmissible, for nothing is more certain than that in this state of splenic cachexia the physiological action of mercury is not only readily developed, but is most prejudicial. Under its influence—and this is not unfrequently seen in the natives of India, where it is sometimes administered by native physicians or others—all the worst consequences, such as sloughing of soft tissues or necrosis of bone, may ensue.

In the case of Europeans who seek recovery by a return to Europe, it is very desirable that the sojourn should be prolonged for a considerable period even after complete restora-

tion to health has apparently occurred; and when the splenic cachexia has been at all pronounced, it is seldom desirable that they should return in a less period than two or even three years, if at all. There was much practical wisdom in the old regulation of the East India Company, that allowed an absence of three years to those who came on furlough after long residence in the malarial climate of India.

The protracted use of iron in some form, and occasionally of quinine or arsenic, especially when there is return of fever, with a residence in a bracing atmosphere, and plain and nutritious food and wine, are the measures by which restoration to health may be expected. It is well, no doubt, that part of the time should be spent at the seaside or at some of the springs or wells in Europe, those combining the chalybeate and aperient properties probably being the best. Much benefit may be derived by short sojourns of six weeks or so, not only from the effects of the mineral waters, but from the change of air, rest, and the physiologically normal mode of living there prescribed.

Dr. J. Macpherson, of the Bengal Medical Service, says, in his valuable work on "The Baths and Wells of Europe" —"Chronic enlargement of the spleen usually disappears when the intermittent fever with which it is associated has been cured. The object is more to improve the general health. The water selected must depend on the strength of the patient. For such as will bear pretty active treatment, Carlsbad, Marienbad, Tarasp; for less robust, Kissingen, Homburg; or iron waters, Franzenbad, Elster, Pyrmont, Spa. In France, some of the arsenical waters are recommended, as Cransac, La Bourboule, also Orezza and Bourbonne. Mud-baths, local douchings, strong brines, may all find their appropriate employment."

Local applications are of little value, but for those who put faith in them the application of iodine in the form of tincture, or as ointment over the spleen, may be resorted to. The best hope of restoration to health, however, lies in such measures as tend to improve the general health, to give tone and vigour to the system, and improve the blood, and these

are to be sought for more in change of climate than in physic.

In those more aggravated states of the disease seen in India, where the spleen is not only enlarged but tender, and the cachexia well developed, where gangrene of any part—such as cancrum oris, or phagedænic sloughing—supervene, the free use of opium in the solid form, with such local applications as may tend to destroy the dead or dying tissues without great irritation of the subjacent parts, are indicated. Chlorate of potash, nitric acid, bark, quinine, arsenic, iron, are the remedies, combined with nutrients of the most assimilable and sustaining character. Happily these aggravated cases are seldom seen, excepting in those, generally children, who are long and unavoidably exposed, under the most unfavourable and depressing circumstances, to the evil influences of malaria in its most intense form. It is almost unnecessary to add that surgical operations, excepting such as are immediately necessary to save life, should be avoided in this state—for the tendency to hæmorrhage, gangrene, or embolism is very great.

Hæmorrhages, whether internal or external, during the progress of the disease, require the administration and it may be the application of styptics, of which, perhaps, the ferruginous are the most efficacious. Ascites may require relief by paracentesis.

I have not attempted to describe all the morbid conditions to which the spleen is liable, and therefore say nothing on the subject of those morbid states in which extirpation of it has been deemed by some authorities expedient. In a few cases the whole or portions of the organ have been removed, and recovery has followed; and the entire organ has more than once been extirpated in the lower animals, and they have continued to live. But the importance of the spleen in the process of sanguification seems so great, and the evil results to the blood from any impairment of its functions so certain, that I doubt much if removal of the entire gland will ever take a place among the successful major operations of surgery.

ACUTE MALARIAL ŒDEMA: BERI-BERI.

(*Lancet*, 1880.)

In the year 1877 a disease appeared in the southern suburbs of Calcutta during the rainy season, and was again observed over a large area of the same suburbs and in some villages to the east of Calcutta in 1878. It subsided as the cold weather advanced. The same disease prevailed in Dacca in January and February, 1879, and appeared at Shillong, in the Cossyah Hills, in October. 1878. Dr. O'Brien states that 200 cases had occurred in that station, and that new cases were appearing daily. He believed that it was imported from Dacca, and records that it prevailed in Cachar, Sylhet, the Cossyah Hills, and some of the stations of Assam proper. This statement is confirmed by Dr. Nairne, of South Sylhet, who reported that it prevailed in August and September.

Dr. K. Macleod, the Health Officer of Calcutta, to whom I am indebted for the above information, says in his municipal report of April, 1880, that the present epidemic broke out towards the close of 1879. A fresh outbreak seems to have occurred in the southern and eastern suburbs, and Calcutta itself was invaded for the first time. The portions of the town where it prevailed are continuous with or contiguous to those parts of the suburbs which were previously attacked, and he gives the number of deaths from this "acute œdema" during the first quarter of the present year. It appears that they were as follows:—

	Mixed Races.		Hindus.		Mohammedans.	
	Males.	Females.	Males.	Females.	Males.	Females.
January	..	..	5	9	3	4
February	..	1	17	14	18	33
March	..	..	6	5	6	22
Totals	..	1	28	28	27	59
	1		56		86	

—making 143 deaths in the three months; the disease apparently being confined almost entirely to the native races, as no death in the case of European, and only one of mixed race, is recorded.

A special inquiry, instituted by Dr. Macleod, of one district, Short's Bazaar, gave the following results:—

Number of houses	60
„ of inhabitants, say	390
„ of houses attacked	10
„ of inhabitants in these	65
„ attacked	15
„ died	10

The rate of mortality given by the town figures is about 20 per cent., and by the suburban about 44 per cent. These figures indicate that the mortality is considerable in relation to cases, though slight in relation to population.

Dr. Macleod, who appears to have investigated the subject with much care and skill, summarizes his observations as follows:—

He says it attacked houses in a village in a promiscuous way—those affected being mostly scattered throughout the locality, and not necessarily contiguous. As a rule, several or all the members of a household have been seized, single cases in a family being exceptional. The attacks occurred simultaneously or in rapid succession, as if from the operation of a common cause. The seizure of different houses in a village seems to have occurred about the same time.

The disease, when the investigation was made, appeared to be dying out.

He summarizes the symptoms as follows:—Swelling of the limbs, the lower most, and the body occasionally.

Fever sometimes before, sometimes after the swelling; in some cases absent. Bowel complaint in many cases, chiefly diarrhœa, but occasionally dysentery.

Burning and pain in the affected limbs at the commencement; shortness of breath, cough and palpitation, great emaciation, exhaustion in severe cases, and anæmia well marked in all.

The duration of the disease appears to be about two months in cases of average severity, leaving the sufferer greatly enfeebled.

In fatal cases there is great disturbance of respiration and circulation; and death is generally sudden.

Dr. Macleod does not describe the condition of the spleen, liver, kidneys, or other abdominal viscera, or the condition of the blood, neither does he allude to the question of embolism or thrombosis, nor the presence or absence of fibrinous coagula in the right heart or pulmonary arteries. In reference to the nature of the disease, which, in the epidemic form at all events, was new in Bengal, he says that it is impossible to write very definitely, but that the prevailing opinion is that it is the disease described in Madras and Ceylon as beri-beri, and that he is inclined to take that view. With reference to causation, he remarks that he has not been able to pronounce a positive opinion, but that, though it is most prevalent among the poorer classes of Hindus and Mohammedans, it is not confined to them, for that Eurasians, Armenians, and well-to-do natives have suffered. Neither is he able to attribute it to poverty of living, high price of food, nor any dietetic condition or consequent constitutional taint; well-fed people, Mohammedans who ate animal food, have suffered; whilst the anæmia and scurvy in some cases were rather secondary than original conditions of the disease. Insanitary conditions do not appear to have been a marked cause, for in this respect the villages and houses where it occurred were not worse than those of many others where the disease was absent. In short,

he was unable to fix upon any one condition, or assemblage of conditions, personal or otherwise, peculiar to the affected places. With regard to contagion, the evidence, he says, is conflicting. By some it is deemed to be infectious, and facts have come to his knowledge that would seem to favour this view. He is not prepared to deny that under certain conditions, seasonal and otherwise, which strongly modify its manner of transfer from man to man, it is so; and that "the gradual spread northwards, the pronounced localization, and the seizure of whole families, are the most remarkable circumstances in the natural history of the malady, considered from an epidemiological point of view."

I am quite inclined to agree with Dr. Macleod that the disease is beri-beri, and I think that reference to the writings of Malcolmson, Rankin, Heyman, Oudenheim, Mason Good, Carter, and others, would confirm the view that the disease, which within the last few years has assumed an epidemic form in Bengal, is the beri-beri described by them.

With regard to its epidemicity, the explanation would probably be similar to that which informs us why dysentery, malarial fever, and some other endemic diseases at times assume the epidemic condition; and has to do, probably, with agencies, with which, as we are yet imperfectly acquainted, it is the aim of the epidemiologist to investigate their nature and laws.

Though apparently novel in the epidemic form it has assumed, the disease can hardly be regarded as new, for it occurs sporadically in Bengal. I have long thought that some of the cachectic, dropsical, wasted creatures one sees among the lower class of Bengalees in town or country may fairly be regarded as sufferers from beri-beri. It is very much to be desired that the pathological anatomy of the disease, the state of the blood, the condition of the heart and pulmonary vessels in reference to the presence of fibrinous coagula, the state of the tissues, and the possible presence of hæmatozoa or other microzoa within the tissues, the blood, or the juices, should be investigated by the highly skilled pathologists who are doing so much to throw light on the causation of disease in India.

Some years ago I made elsewhere a few notes on beri-beri, and, as it may be of interest, I would offer a few additional remarks on the subject:—

This disease, which is familiar to English writers as beri-beri, is best known in Southern India and Ceylon. It is endemic on the coasts, extending inland forty to sixty miles, especially in the Northern Circars, Ceylon, and on the Malabar Coast. It occurs also occasionally in other parts of India—in Bengal, where it has recently been epidemic, in Central India, and in the Deccan, and probably all over the peninsula. It is known in Burmah and the Malay peninsula, and in the crews of ships trading to the Persian Gulf, Red Sea, Coast of Africa, Bay of Bengal, Singapore, Siam, and the Indian Archipelago.—(Carter, Morehead, and others.)

On the West Coast, as in other parts of Africa, it is known as the "sleeping sickness"; and Biermer has described a pernicious form of anæmia which seems to be identical, or nearly so, with it, in Europe. It probably occurs wherever certain conditions of climate, soil, water, food, and habits of life prevail. The name is of doubtful origin, and is unknown to the natives of India. Herklotts says it is unaccountable how it crept into general use. It may be, he suggests, from the Hindu word "*bheri*," a sheep, from the fancied resemblance of the gait of the persons affected, to that of a sheep. Some think it is derived from a Cingalese word meaning weakness, the reiteration meaning great weakness.

Carter suggests *bahri*, a sailor, from the Arabic word *bahr*, sea, and *bhayr*, shortness of breath. This may be, as it occurs among Arab sailors.

It has various other origins assigned to it, generally signifying weakness, and has other synonyms.

According to Malcolmson, the disease in his time was very prevalent among the natives of the Northern Circars, especially in the jails of Masulipatam, Rajamundry, Vizagapatam, Chicacole, Cuddapah, Bellary. The death-rate in these sites reached 36·5 per cent. among the prisoners, while among sepoys it was 13·9 per cent., among Europeans

26·2 per cent., showing that the unfavourable conditions of prison life intensified the disease. Mohammedans suffered more than Hindus. The European mortality was also high. It prevailed most towards the close of the rainy season; wet and cold seemed to develop the tendency to the disease.

It would appear that it occurs where causes of debility have been some time in operation, especially in certain climates and localities; certain conditions of soil, air, and water; great alternations of temperature, especially when attended by wet, fatigue, mental and physical depression, deficient or defective diet; malaria and other undefined atmospheric and telluric influences—all, in fact, that tends to depress vital energy, impoverish the blood, and starve the nerve-centres. The symptoms, *it is said*, seldom begin to appear within ten months or a year after first exposure to the causes. Its prevalence in certain districts seems to point to causes intensified in those localities. Its occurrence in other inter-tropical countries, and even at sea, and its epidemic visitations—as recently in Bengal—suggest that it is to be classed among general rather than specific diseases; impaired nutrition, under certain peculiar circumstances, rather than any specific disease! Rankin thought it was a result of renal disease, but there is no evidence that I know of to show that it is so, or that it is due to structural change in any of the viscera. Morehead considered that it might have a scorbutic origin.

The phenomena of beri-beri are those of anæmia and general dropsy; œdema and pain of the limbs and body generally, numbness, heaviness, loss of power, sometimes paralysis, dyspnœa, palpitation, irregular action of the heart, anæmic cardiac murmurs, small quick pulse, dryness and heat of skin, impaired appetite, torpor of bowels; urine may be scanty and high-coloured, specific gravity 1020 to 1040, no albuminuria as a rule. According to Horton (Africa) and others, excessive drowsiness and stupor attend some stages of the disease. The tongue is pale and flabby, the mucous membranes are pallid, there is occasionally hæmorrhage from the stomach or bowels, petechial eruptions,

diarrhœa, an anxious expression of the countenance, which is puffy, swollen, and sometimes livid; a peculiar tottering gait.

The disease presents itself in the chronic and acute form; rarely, it is said, in either form until after exposure of some months to the exciting causes. I have described the general symptoms, and it remains only to say that it frequently assumes a lighter and modified form, with anæmia, numbness, a certain amount of pain in the limbs, anxious expression of countenance, disordered bowels, scanty urine, cold skin, and feeble irregular pulse, palpitations, nervous depression, puffy face and neck, or unsteady gait in walking. There is also in some of the cases a peculiar burning of the feet which is very distressing.

Malcolmson describes this condition in connexion with beri-beri, to which, he says, it is allied; it affects the soles of the feet, the calves of the legs, the back, and occasionally the muscles of the legs generally. Recent observers in India have mentioned it as occurring also in the upper extremities. It occurs in recent and slight examples of beri-beri, and appears to have been observed in the troops after the first Burmese war. It sometimes occurred in men who had not had other symptoms of beri-beri. Malcolmson thinks that it is neither really rheumatism nor beri-beri, and that it may accompany or follow other diseases, and is an indication of nervous debility.

The acute form of beri-beri has often very severe symptoms, and the rate of mortality from it is very high—second only to that from cholera. There is rapid general anæmia, and dropsy of cavities and areolar tissue, scanty urine, constipation, weak irregular pulse, intense præcordial pain, hurried irregular respiration, occasional vomiting sometimes of blood, swelling of limbs, numbness, pain, paralysis, preceded by a feeble, tottering gait, pleuritic and pericardial effusion, and death, either from syncope or, as I should think, from the formation of fibrinous coagula in the right side of the heart or in the pulmonary artery. In this acute form, as I have said, it is very fatal, but in the milder and more chronic form recovery is frequent. Until the recent outbreaks in Bengal the disease had not

received much notice in the sanitary reports; but I find in the Army Blue-book for 1871 notice of fifteen cases that occurred among native troops in Ceylon, and of seventy cases in the Ceylon Rifles in Labuan. No European deaths are recorded in the above period. The inference would be that the disease, if it has occurred, has been referred to anæmic dropsy. No post-mortem examinations, so far as I know, have been recorded during the late outbreak in Bengal, nor has any special examination been made of the blood or lymph. The recent discoveries of certain micro-organisms in the fluids and tissues may not be without significance in this disease. In such records as I have seen of the morbid anatomy it would appear that there was general effusion of serous fluid in the areolar tissue and tissues generally. All were soaked with serous effusion, and were soft and degenerate; the muscular fibre fatty and feeble, especially that of the heart, which was often enlarged and dilated; kidneys softened, enlarged, and anæmic. But though hepatic, splenic, or renal complications may exist, intensify the severity, and hasten the progress of the general symptoms, they are not essential concomitants of the disease, and appear to originate in the spanæmic state of the blood, and to be kept up by its progressively imperfect elaboration. The resulting partial starvation of the cerebro-spinal centres and the consequent degeneration of tissue, sufficiently account for the paralysis which in some cases characterizes the disease.

Prevention and Treatment.—Proper food, suitable clothing, and protection from vicissitudes of climate, wet and cold, tend to prevent; whilst faulty hygienic arrangements, bad and exhausting habits, all tend to promote the development of the constitutional condition in which it commences. When the disease is established precautions against these are still necessary, and the symptoms must be treated as they occur. Diuretics and diaphoretics to relieve the œdema and dropsy; tonics and stimulants to give vigour to the weakened muscular fibre; and food and remedies that may improve the condition of the blood.

In the more aggravated and acute cases the indications are still the same, whilst remedies that are calculated to prevent exhaustion or the tendency to fatal syncope and embolism are indicated.

Acetate of potash, digitalis, and squill occasionally—very occasionally, I should say—combined with calomel, are said to favour the removal of the fluid; needless to say that mercury is to be avoided; salines may at some stages be found useful.

The object being to strengthen the muscular fibre, iron and other tonics are needed; but no treatment will be of much avail, if the patient be not placed in favourable hygienic conditions. Among other remedies, Malcolmson speaks highly of two—treāk-farook, and oleum nigrum, procured originally at Masulipatam. These were considered to be most effective in relieving the œdema and dyspnœa, which it is said proved very fatal until they were introduced. The treāk-farook is a black electuary, imported, says Waring, from Venice, and is the Theriac Andromachi of old writers. It is used for other diseases besides beri-beri, such as rheumatism. Mr. Geddes first brought it into notice, and he employed it in combination with rhubarb, cinnamon, cloves, and honey; good food and milk being given at the same time. A similar mode of treatment is advocated by Malcolmson. The composition of the treāk is apparently unknown, but it seems to be stimulating, diuretic, and probably not aperient, unless combined with rhubarb.

The oleum nigrum, which is also highly spoken of by Malcolmson and others, is prepared from the seeds of Celastrum nutans, combined with benzoin, cloves, mace, and nutmeg; it is stimulant and diaphoretic. Given three times a day, it is said to have been beneficial in several cases of beri-beri. There is, I should imagine, no good reason for supposing that these remedies have any specific action beyond the peculiar properties which they probably share with terebinthinates in stimulating capillary action.

No doubt both native and European physicians in India will be able to devise other remedies just as effective.

Nux vomica has been found useful in certain cases, and opium may be needed to allay pain and irritability. Hepatic and splenic complications require appropriate remedies.

Obviously the indication is to promote removal of œdema, to regulate the functions of the abdominal viscera, increase the action of the skin, and to give tone and vigour to the muscular fibre, appropriate diet, careful hygienic arrangements, change of locality, and such remedies generally as will tend to improve the condition of the blood. By such measures can we hope to deal successfully with this disease.

Since writing the above I have been favoured, by the Colonial Office, with a report on a recent outbreak of beri-beri in the criminal prison at Singapore, by Dr. Rowell, principal medical officer of the Straits Settlement. The disease was first recognized in the early part of May, 1875; but it would appear from the records that it had occurred from time to time in a spasmodic form, and had been classified under the heads of œdema, general dropsy, rheumatism, and paralysis.

At first it appeared in Malays under long sentence, but it spread to all prisons, including Chinese and Indians.

With the exception of the year 1877, which was an unusually dry one, and was one in which all the prisoners were employed in labour outside the prison, the disease made steady progress; till, owing to the increase in number attacked, it was found necessary in April, 1880, to recommend that the whole native portion of the jail should be condemned as unfit for occupation.

The European and general native prisoners enjoyed perfect immunity, owing to the fact that they occupied a quarter in the jail better drained and ventilated than that in which the Malays were placed.

The ratio of mortality in the jail from this disease in 1878 was 16·20 per cent.; in 1879, was 20·63 per cent. The increase in 1879 was owing to many of the admissions being cases of relapse, and increasing virulence of the disease.

But this ratio contrasts favourably with that of similar outbreaks in India, Ceylon, and elsewhere.

The nature of the disease is obscure; it is supposed to be endemic in the Tropics, to be restricted to certain latitudes, and not to extend further inland than forty to sixty miles. It is, however, well known and has been described as existing in an endemic form in certain low-lying parts of Japan, where it occurs only during the hot weather, and has no existence in the colder regions. In Java, Sumatra, Ceylon, and in Southern India, and the northern parts of the Madras Presidency, it has long been known, and is very fatal—often rapidly so.

The decline and setting in of the monsoon, with its vicissitudes of temperature and moisture-laden atmosphere, excessive rainfall; and protracted detention in the jail—though the period has been contracted as the disease became more severe—have had much influence in developing it.

In most cases the commencement of the disease was insidious and difficult to detect. There was a tendency to the development of a watery condition of the blood, accompanied by debility, small pulse, short breath, throbbing in the vessels of the neck, bruit in the cervical veins, and palpitation on the least exertion.

The symptoms were in some cases sudden and severe; as observed in the jail at Singapore, they were of the following character:—"Weakness, lassitude, languor, inaptitude for exertion, stiffness and formication of the legs and thighs, followed by numbness; later by œdema and sometimes paraplegia. The numbness extends to the upper extremities and abdomen. The body commences to swell; there is a distressing sense of fulness at the pit of the stomach, increased after meals; tension, weight at the precordia; difficult breathing, especially on motion, and the usual train of symptoms attending thoracic effusion. With the progress of the disease the dyspnœa becomes extreme; sleep becomes uneasy; there is difficulty in lying down; vomiting is often present, and muscular spasms of different parts of the body occur. The pulse increases in frequency and feebleness; there is

fluttering about the heart; the lips and countenance become livid; there is a scared aspect; the extremities become cold, and the patient soon dies."

In the sudden cases these symptoms have followed one another with the utmost rapidity, and a few hours have sufficed to close the scene. The bowels are, as a rule, torpid, requiring for their evacuation the occasional use of purgatives. Diarrhœa and dysentery have been exceptional. The urine is scanty, high-coloured, sometimes albuminous, and fatal cases are preceded by almost complete suppression. The intellect remains, as a rule, unclouded, and consciousness is retained to the last. Scorbutic symptoms have shown themselves in some cases by the presence of spongy gums alone. A white line at the commissure of the mouth is an almost universal premonitory sign.

Burning of the hands and feet has not been observed in this outbreak. In many cases little beyond pains of a rheumatic character in the limbs has been complained of, no œdema being present. The most quickly fatal cases have been unaccompanied by visible outward signs of disease. Relapses were frequent, each fresh attack adding to the danger.

In discussing the cause of this outbreak, Dr. Rowel remarks that drinking-water as a cause may at once be dismissed, as the water is excellent and is brought from a reservoir five miles distant. It is supplied to the town, where the disease did not occur.

Neither can the diet be blamed, for it was liberal, sufficiently nutritive, varied, and increasing. The nitrogenous element was certainly deficient, but this was to be rectified. It is, moreover, a diet on which prisoners in other parts thrive, and is certainly better than the prisoners could have had before they entered the jail. Climatic, aggravated by local conditions, seem to be the real causes.

Beri-beri is the result of a malarial poison arising from decomposition of organic matter in the soil, intensified by moisture; it acts primarily on the spinal cord, depresses the vital powers, and deteriorates the condition of the blood.

Such is the view taken by Dr. Rowel of the etiology of the disease; it is much in accord with that taken by others, and derives support from the insanitary state of the jail, which is an ill-constructed building placed in an old mangrove swamp at an average level of two and a half feet above high water, surrounded by high walls, alongside of which runs a tidal stream much contaminated by inorganic impurities.

There is no subsoil drainage; such as do exist are surface drains.

In the part of the jail occupied by the native prisoners, the bank dividing it from the stream is low, and after heavy rains there is an overflow or reflux of water into the prison ground, causing excessive dampness, and at the same time stagnation of the subsoil moisture. It appears that certain flood gates erected in 1878 aggravated this condition, and as Dr. Rowel says, the increase of sickness, as shown by statistics, corresponds to the date of their erection.

It is further shown that the soil of the prison ground is most insanitary. "The surface soil is a made one, averaging two feet in depth, consisting of about six inches of white sand on the top, then twelve inches of red earth, and lastly six inches of black slush, resting on mangrove mud. It is loose and permeable, readily absorbing and retaining moisture, and capable of the easy transmission through its substance of the gases resulting from the oxidation of the organic matter beneath it."

The subsoil water was one and a half to three or, at the most, four feet below the surface. Analysis showed it to contain organic matter, which gave out a "bad smell." In addition to all this the prison walls were so high as to prevent the due circulation of air, confining it, and tending to accumulate and condense the malarial poison.

There were, moreover, high walls intersecting the prison quadrangle. Sheds and dormitories close and confined, and on the ground floor no free current of air passing beneath or around them.

The report concludes with remarks on treatment, and

suggestions as to the hygienic measures necessary to remedy a state of things which it is difficult to conceive could ever have been allowed to exist. Change of locality to a purer air was, as might have been expected, attended with success, whilst treatment by drugs or any other means, on the spot, was unsatisfactory.

Dr. Rowel's remarks on the morbid anatomy and treatment are interesting.

Morbid Anatomy.—"In the generality of cases a most striking and unusual deposit of fat throughout the body—this was one of the appearances earliest noted. Effusion of serum in the areolar tissues throughout the body—this is, however, absent in many of the cases, especially such as have had a short duration and been suddenly fatal. Effusions of varying amount into the chest and pericardium—the quantity effused into the latter space has averaged from three to four ounces. There is generally effusion into the abdomen, but rarely amounting to ascites. In all cases effusion has been found, not only in the ventricles of the brain, but on the surface of the cerebrum itself—the quantity of this, however, is very variable. There is effusion into the spinal canal, which accounts for the paralytic symptoms. The heart is, as a rule, enlarged and flabby, surrounded by deposits of fat. The structure of the valves has been found to be affected, whether accidentally or not it is impossible to say. In the heart-cavities large masses of coagulated lymph have been of frequent occurrence. The musculi pectinati are often hypertrophied, as also the whole muscular substance of the heart. There is no doubt that death in this disease often takes place from embolism on account of clots passing into the circulation. The lungs are œdematous; the kidneys pale, enlarged, fatty; spleen pale and more than ordinarily friable. The brain sometimes, and the cord always, have been found congested. There is no doubt that it is the cord which is primarly affected in the disease."

Treatment.—"It was thought better to treat the sick as out-door patients, and apportion them light labour suited

to their state, than to take them into hospital without positive occasion, and perhaps with harm. This procedure was a wise one, and attended with the best results. The purely medical treatment was simple enough, the cases being treated generally in accordance with the symptoms. When constipation, which was common, existed, a ten- to twenty-grain dose of calomel was found to answer very well, as also a half-grain to one-grain dose of elaterium in combination with four or five grains of pil. rhei co., or a half-drachm dose of pulv. jalapæ co. After the bowels were well evacuated, the symptoms of œdema and tightness about the body were found much lessened, and a mixture called 'Steel Diuretic,' of a tonic and derivative nature, was frequently administered. This was a combination of tincture of steel, acetate and nitrate of potash, spirits of nitre, and has answered very well throughout. Drastic purges were only used when there was obstinate constipation, and the dropsical symptoms marked. Oleum nigrum, an oil procured from India, and of great supposed efficacy, was tried, but disappointment was the result. Lime juice was ordered to all the long-sentenced prisoners outside the hospital, and though continued for some time, had little or no effect. Cream of tartar drink was freely given to the sick. A mixture of gin and acetate of potash and nitrate of potash was tried, and answered fairly well. Hot baths and jaborandi were tried, to act on the disease through diaphoresis, but were attended with doubtful success. The combination which has succeeded best and yielded most uniform good results is one of twenty drops of tinctura ferri perchloridi, with ten to fifteen of tinctura digitalis, in a tonic vegetable infusion, given three times a day. When dyspnœa set in, diffusible stimulants—ammonia, ether, and camphor—in large and repeated doses were given with alcoholic stimulants. A dose of gin at bed-time was given to almost all cases. In the more chronic and rheumatic cases, iodide of potassium and tincture of aconite in suitable doses were given, and when paralytic symptoms were present, ergot and nux vomica combined were the most reliable drugs. The diet consisted of

easily assimilable food, milk and sago, bread and milk, beef-tea, chicken soup, and stimulants as required, and gin to almost all cases."

Locally.—"The local treatment is of much importance. Daily frictions of the extremities with some stimulating liniment and flannel bandaging. When dyspnœa sets suddenly in, the application of a large blister to the chest is the best remedy, aided by mustard poultices to calves of legs, etc. Mustard cataplasms over epigastrium, blistering the spine, counter irritation over the kidneys, the button cautery to the spine have all been found useful in suitable cases. In conclusion, it is only to be regretted that a more successful treatment for this disease has not yet been discovered. The milder and more chronic cases are simply enough treated, but in these sudden and severe cases, the physician feels himself as helpless as if he were in the presence of a case of cholera of the worst type."

The report is very valuable, as it so clearly traces the disease to its origin—insanitary local conditions, co-operating with climatic influences—and it is only another proof of the danger arising from subsoil damp, when in a state of stagnation, in combination with decomposing organic matter. Why the peculiar group of conditions to which the name of beri-beri has been given should be the result in this particular case it would be hard to say. We can only affirm that in such conditions disease is likely to occur, and that it may assume this form, or that of dysentery, or of fever. What special conditions determine which of these it shall be we are unable to say; but Dr. Rowel has clearly shown that in this instance beri-beri is attributable to the local insanitary conditions, and what means should be adopted in future for prevention, or amelioration if it should occur. Whilst distinctly expressing the opinion that the disease is not communicable, he shows that it assumed an epidemic form:—"A very ready reason can be furnished for its appearance in Penang Prison, where it occurred after removal to that establishment, of the Singapore prisoners affected, by the fact that at that time it was

showing itself, without any seeming cause, in all parts of the Malayan Peninsula, as well as in the adjacent countries." This condition, which became epidemic, was intensified, if not originated, in the insanitary jail at Singapore.

Whilst the foregoing remarks on beri-beri were in the press I have received a most elaborate and interesting article on the disease by Dr. Duane B. Simmons, of Yokohama, It is known in Japan as kakké, and occurs in the summer months, especially in the seaport towns on the eastern and southern coasts of the Japanese islands, "chronic as to form, but subject to exacerbations of varying degrees of severity, having for its characteristics anæsthesia of the skin, hyperæsthesia and paralysis of the muscles, anasarca, palpitation, cardiac and arterial murmurs; in the wet form, pre-cardial oppression and abdominal pulsation; and for its cause a miasmatic or specific soil exhalation. It has two distinct forms—the wet (beriberia hydrops) and the dry (beriberia atrophia): cases of both are met with in the same locality, the former more frequently when the summers are attended by an unusual amount of rainfall and moisture, and the latter when the seasons are of unusual dryness. The wet form is by far most to be dreaded, as it runs a rapidly fatal course in defiance of all known modes of treatment. The dry form is rarely fatal."

Dr. Simmons says that barbiers, though regarded by a number of writers on Indian disease as distinct from beri-beri, is, beyond question, only a form of it, or what he calls dry beri-beri.

BRONCHOCELE.

"*Lancet*," *October* 24*th*, 1874.

At a meeting of the Pathological Society, on the 19th May, bronchocele was described as occurring in the lower animals as well as man, and among other points of interest connected with its etiology, it was suggested that there was good reason for believing that the presence of iron pyrites in the soil had something to do with its occurrence.

The subject of goître has received much attention from observers in various parts of the world, and all seem to concur in the opinion that wherever it occurs, and however different the conditions under which it presents itself, one unvarying element in causation is the presence of lime in some form in the drinking-water; and that whilst, on one hand, it is found chiefly, if not entirely, in districts where the geological formation is characterized by the presence of magnesian limestone, on the other, it is absent from parts of the country, which, though in other respects similar, are marked by the absence of lime. My experience of the disease is chiefly such as I have obtained in India, though I have had opportunity of observing it in the valley of the Rhone and in other parts of Switzerland; it is therefore in reference to bronchocele as it occurs in India that I would offer a few remarks.

The almost universal testimony of observers is in favour of a calcareous origin, and the evidence adduced leaves little doubt of its general truth; wherever the disease occurs—and its geographical distribution is very wide—goître appears when

the geological strata are characterized by the presence of limestone rocks, or their detritus, which, being washed down from the hills into the plains, impregnates the soil and water of contiguous districts.

The late Mr. Brett, of the Bengal Medical Service, alluding to the exciting causes of the disease, remarks that the general conclusions arrived at by Messrs. M'Clelland and Inglis respectively, in India and England, show that "in primitive districts, where limestone does not exist as a principal rock formation, goître is not found, or, if found, it is in the proportion of one to five hundred of the population; whilst in transition districts, where limestone prevails, one-seventh of the whole population is affected with goître. And that further, the population is not equally affected in every village, one being affected in the midst of others which are healthy, and *vice versâ*."

Lofty localities, deep mountain valleys, marshy districts, snow water, water impregnated with vegetable or other matter, the use of particular articles of food, deterioration from frequent intermarriage, changes of temperature, have each and all been charged with producing goître, though probably without sufficient reason.

Now, although it is probable that bronchocele occurs most frequently under conditions which seem to indicate a calcareous origin, and also occasionally under circumstances which appear to suggest other causes, such as those to which I have referred, yet none of these seem to be altogether certain; and it is probable that the real cause has yet to be discovered, for the disease undoubtedly may occur where none of these exist, as it may be absent where they prevail.

Goître is exceedingly prevalent in some parts of India, and remarkably so in certain districts which are marked by their extreme insalubrity in other respects. The whole extent of the Terai—that is, the forest and marshy land—the Piedmont, which ranges along the foot of the Himalayas, where the most deadly forms of malarious fever prevail, abounds in goître; and Major Holmes, who, when com-

manding at Segowlie in 1857, made it a special subject of investigation, writes as follows:—"In the districts about Motiharie, Segowlie, Bethia, Bhagolia, and on to Gorruckpore, indeed along the whole line of the Terai, goître is so prevalent that it can hardly be an over-estimate to state that in many localities one individual in ten is afflicted with this terrible disorder." And it appears that in the cold season of 1854-55, Captain Cunningham, another officer of the 12th Irregular Cavalry, who was stationed in the Terai, and who seems to have made a discovery in therapeutics which would have done credit to any medical officer, treated about 25,000 cases, as many as 500 a day coming to him for this remedy, and with great success. For this interesting and very important information we are indebted to Inspector-General Dr. F. J. Mouat, who placed it on record in the *Indian Annals of Medical Science* of October, 1856.

I cannot pretend to such experience of the disease as that related by Major Holmes and Captain Cunningham; but in frequent visits to the Oude Terai, I have had opportunity of seeing how grievously the inhabitants of these districts suffer, and have long been under the impression that the malaria which causes fever, anæmia, leucocythæmia, enlarged liver and spleen, and the consequent cachexia, so prevalent in those districts, is also concerned in the production of this abnormal condition of the thyroid gland; and considering the analogy of this to other blood-vascular organs, particularly the spleen, it is not unreasonable, I think, to suppose that what so seriously affects one, may, in some degree, affect the other.

It is possible that the combination of the malarial influence affecting both water and air, impoverished diet, and other unfavourable circumstances under which those people maintain existence, may, when added to the more generally recognized cause—calcareous impregnation of the water—to some extent account for the excessive prevalence of goître in these parts of India. Not that it is confined to the Terai; for there are few parts of India where it may not occasionally be seen, and some villages and com-

munities, such as parts of Tirhoot, at a considerable distance from the submontane regions referred to, furnish ample proof of its more general distribution.

With regard to lime in the water as a cause in the Terai districts, Colonel Sleeman has pointed out, in his work on Oude,—"The kingdom of Oude must once have been the bed or part of the bed of a large lake formed by the diluvial detritus of the Himalaya chain; and, as limestone abounds in that chain, the bed contains abundance of lime, which is taken up by the water that percolates through it from the rivers and from the rains and floods above. The lime thus taken up and held in solution with carbonic acid gas is deposited around the small fragments of flint or other hard substances which the waters find in their way." These nodular masses are called "kunker," and are the staple for road-making in India. They consist, according to O'Shaughnessey, of carbonate of lime, silica, alumina, and sometimes magnesia and protoxide of iron. Their existence, in fact, accounts for the presence in the water, which has percolated from the hills and infiltrated the subjacent soil, of agents which are generally considered to be so potential in causing bronchocele.

In a paper contributed by Mr. H. M. Greenhow, of the Bengal Medical Service, to the *Indian Annals of Medical Science* of July, 1859, he alludes to the presence in the water, from similar physical causes, of salts of sodium; it is questionable if this can be regarded as having anything to do with the causation of goître, but Mr. Greenhow remarks: "I cannot help concluding that drinking-water containing lime is the main cause of goître. At the same time it must be admitted that the exact mode of action of this calcareous water on the system is as yet unknown to us; and it is also, as it appears to me, uncertain whether other circumstances do not aid the development of goîtrous tumours. One of these circumstances is the impregnation of drinking-water with soda, and possibly potash. I do not know that carbonate of soda, which is very probably connected with the lime in the water, has ever been specially referred to as

taking a part in the causation of goître. Dr. Inglis, indeed, as before noticed, mentions that in Tirhoot, where goître is very common, the soil is saturated with saltpetre. Now, as I mentioned in noticing the topography of Secrora and the trans-Gogra division of Oude, the soil contains a great quantity of soluble salts, which are deposited on its surface, and which render it *oosur*, or barren; and this is the case not only in Oude, but in Scinde, in Egypt, and probably, as General Sleeman remarks, in the 'greater part of the deserts which now disfigure the face of the globe in hot climates.'

"The salts of sodium thus brought to the surface affect the soil, and of course must affect the water too; whether the resulting carbonates play a part in producing goître seems an interesting question, and one on which I should gladly be able to offer more evidence. I throw this out more as a suggestion for future inquiry than anything else, and, indeed, as it does not appear that there is anything like the correspondence between the occurrence of salts in the earth and water and of goître, that there is between the impregnation of the water with lime and the prevalence of goître, it may be that these salts have nothing to do with the causation of the disease.

"With regard to *race*, I do not think that this can be considered even as a predisposing cause of goître, for we have all nations—Europeans, Asiatics, and Americans—affected by it. Among the natives of India I cannot make out that one *caste* is more prone to the disease than another. Most of my three hundred cases were Hindoos; but then the mass of the Oude population is Hindoo. The Mussulmans, I should suspect, are equally liable to it, for I have had many cases among them also—perhaps as many in proportion as amongst the Hindoos. Of the latter, no one class seemed to be more liable to the disease than another."

Without expressing any positive opinion on the subject, I would merely point to the extreme prevalence of goître in the malarious Terai, as suggesting another origin, in addition to the presence of lime or iron in the water of the springs,

wells, and subsoil drainage of that region. The association of goître with cretinism, especially in Switzerland, is notorious, and in some localities it seems to be more common than in others; but it is remarkable that this is not so in the goître of India, and especially in that of the Terai. Mr. Greenhow says that of three hundred cases of goître, only one was of weak intellect, and not a cretin. Nor do I remember ever to have seen a well-marked instance of cretinism in India, though I have seen feeble and imbecile persons who were the subjects of goître and spanæmia. Many who were the subjects of advanced goître were otherwise strong and in excellent physical and mental health.

Mr. Greenhow further remarks, "that though in Switzerland the same causes may seem to conduce to the production of goître and cretinism, there are some circumstances which lead to the occurrence of the latter which are not necessary to that of goître, and that the converse is probably true. Cretinism appears to be an essentially hereditary disease, which goître is not."

I have not noticed, nor has it, I believe, been observed by others, that goître in India is associated with exophthalmos. If the morbid condition of the thyroid body depend on a neurosis, and consequent disturbance of the normal vaso-motor arrangements, it seems to be limited to the thyroid body itself, and generally, most remarkably, to the right lobe. The extreme vascularity of this organ, which is supplied by four arteries, the united diameters of which, according to Hyrtl, is not much less than that of those which supply the brain, enables it to increase very rapidly under certain influences, and exposure of a few days to the exciting causes has been sometimes known to produce a well-marked bronchocele.

Many varieties of bronchocele have been described; they probably, however, all represent but the progressive effects of hyperæmia and proliferation, resulting in various forms of hypertrophy, whether vascular, fibrous, or cystic.

Though frequently associated in India with cachexia, I have often seen large goîtres in persons, most frequently,

perhaps, in women, who were otherwise in sound mental and bodily health. All races in India are subject to the disorder; most common among Hindoos, because they form so large a proportion of the population of the districts in which it is endemic. It is not limited to any age; early childhood, middle and later life are effected. Mr. Greenhow thinks that the greater number of cases will be found between twenty and forty years of age; and I have no statistics to show its relative prevalence in either sex. It does not appear to have any marked relation to, or to be attended by any serious disturbance of, the menstrual functions, but it has been noticed, in some instances, that the tumour is fuller than usual during or near the catamenial period.

It has been observed that the lower animals suffer extensively. "At Hissarpore, a village on the Ganges about twelve miles distant from Secrora, dogs and other animals are affected." The late Mr. Bramly, of the Indian Medical Service, observed it, in Nepal, in goats, kids, sheep, lambs, dogs, and puppies. The late Mr. Brett, in his "Surgery in India," says: "Bronchocele is congenital in animals in Nepal; almost the moment the animal is born it expires. We are indebted to Dr. Campbell, of Katmandoo in Nepal, for an account of the pathology of the disease in sheep and goats. He invariably observed a complete want of development in the muscles leading from the sternum to the os hyoides and thyroid cartilage; whether from pressure of the tumour on the parts during gestation, which he supposes, or diversion of nutrition to the morbid growth, it is difficult to decide.

As it seems pretty well settled that calcareous water is the chief cause, so it is decided that iodine in some form is the best remedy in goître; and it is needless to prolong these remarks by detailing the various other remedies that have been suggested for its treatment in a country so fertile in nostrums as India. There can be little doubt that if the disease is treated early by the application of iodine and the use of quinine, and perhaps arsenic, and by removal from

the endemic area, or, if that be impracticable, by changing the water and making some variation in the residence, great benefit, if not absolute removal of the disease, may be secured. To obtain the most satisfactory results it should be treated early, before advanced tissue-change has occurred. If the treatment be adopted at a later period, it may still be beneficial, though less so than in the early stage.

We are indebted to Captain Cunningham and Major Holmes for our knowledge of the valuable properties of the biniodide of mercury in the treatment of goître by external application. These officers, when stationed in the Terai, were struck by the extent to which the inhabitants suffered, and turned their attention to finding some remedy, with what result may be gathered from Captain Cunningham's statement, who says: "In the cold weather of 1854-55 I must have treated upwards of 20,000 or 25,000 goîtrous people, and in one day I have seen as many as 500 at my house, who were all treated." The remedy is prepared and applied as follows:—Melt 3 lb. of lard or mutton suet, strain and clean; when nearly cold, add 9 dr. of biniodide of mercury, taking care to make the powder fine by trituration in a mortar; work in the mortar until no grains of red are apparent in the ointment, and put in pots for use, taking care always to keep both powder and ointment from the rays of light. Use as follows: About an hour after sunrise apply the ointment to the goître with a spatula made of ivory or of the thin, broad, smooth bamboo, quantity according to the size of the tumour; rub it well in for at least ten minutes. Let the patient then sit, with the goître held well up, in the sun, and let him remain so as long as he can. It is probable that about noon he will suffer severe pain from the blistering effect of the ointment, although no pustules are raised in the skin. About 2 P.M. the ointment should be again applied with a very careful and tender hand, and the patient should be despatched to his house with orders not to touch the ointment on any account with his hand, but to allow it to be gradually absorbed, which absorption will be complete on the third day. This treatment is quite sufficient

for an ordinary case. Should it be a very bad one, the patient is ordered to return next year for the removal of what may remain of the tumour. Except in goîtres of the very largest size, this is seldom necessary. After the application of the second year no goître has been known to continue.

The patients begin to come about the middle of November, and continue till the end of March; after that time the sun's rays act so violently on the medicine that it is not advisable to apply it. Both Major Holmes and Captain Cunningham seem to have great faith in the efficacy of the drug, but the latter says:—"To my certain knowledge the biniodide of mercury did fail in one case to effect a cure. I applied it myself seven or eight times on one man, and was particularly careful in seeing that he did not rub it off; but it did not act in him, which I could not account for. In old cases, where the goître has become as hard as a stone and about the size of a turkey's egg, I have found it fail; but where the flesh is soft I have seen the goître wonderfully reduced. I have never heard of any instance in which danger arose to the patient from application of the biniodide of mercury." I have on several occasions tested the value of this remedy; and, though I do not remember ever to have had the opportunity of watching a case to the end, I have seen enough to assure me that it is capable of diminishing the size of the tumour after one or two applications. The application is not altogether free from inconvenience or even danger. I have known it to produce violent inflammation in the neck, and give rise to much suffering. I have also, in one instance, known severe and dangerous salivation to result, and more than once I have seen ptyalism in a milder degree follow its application. Still the remedy is a valuable one, and deserving of more attention than it appears to have received in Europe.

As to operative interference, I believe it is unjustifiable, except in cases where life is in imminent danger from pressure. On one occasion I applied ligatures to two very large arteries, one on either side of a large bronchocele of old

standing. The vessels—probably the superior thyroids—were superficial, and of enormous size—larger than a goose-quill; but beyond a temporary arrest in the growth of the tumour no benefit was conferred. The patient did not remain, after the healing of the wound, to submit to other treatment, so that I had no opportunity in that case of testing the value of the biniodide.

The internal administration and external application of iodine in some form have long been practised in India in the treatment of goître, and Mr. Brett speaks of an ointment composed of iodide of potassium half a drachm, iodine one scruple, and adeps one ounce, as an effective application, combined with scarification or leeches, and the internal use of the tincture of iodine.

Major Holmes' and Captain Cunningham's experiences of the beneficial action of biniodide of mercury have been made known by Dr. Mouat, and I believe that the careful application of this remedy, combined with the internal administration of quinine, iron, and arsenic—bearing in mind the possible combination of a malarial origin with that due to calcareous, ferruginous, or other impregnation of the soil and water—offers the most reasonable prospect of benefit, which would not only be enhanced, but probably confirmed, by removal to another climate, or, if that be impracticable, by even a change of locality and of the drinking-water.

Valuable contributions on the subject of goître, its causes and treatment, have appeared from time to time in the Indian medical journals, by Dr. Campbell and Messrs. McClelland and Bramly; in the Medical and Physical Transactions of Calcutta; by Mr. Brett in his "Surgery in India;" and more recently by Dr. F. J. Mouat and Mr. Greenhow in the "Indian Annals of Medical Science."

ELEPHANTIASIS ARABUM.

Lecture to the Students of Charing Cross Hospital, March, 1879.

The subject to which I propose to direct your attention is Elephantiasis Arabum—a disease seldom seen in this country, but of frequent occurrence in certain tropical and inter-tropical climates, and therefore well worthy of your consideration, as it is not improbable that some of you may have to exercise your profession in those countries.

Whatever the causes may be—and I shall tell you of those to which it is generally assigned—there can be no doubt that this disease gives rise to most remarkable outgrowths, and necessitates most formidable surgical operations, which, in the majority of cases, are followed by the happiest results, and are often the only treatment to which it is amenable. Indeed, I scarcely know of any morbid condition in which greater relief is afforded, or in which the good results of a surgical operation are more signally demonstrated. Of course, you will understand that I do not intend to discuss the question merely from this point of view, but in its more extended aspects as a constitutional disease, and in relation to various etiological questions that have from time to time arisen in respect of its geographical distribution, and the predisposing and determining causes of its occurrence in certain individuals and in certain localities.

I am able to show you specimens of the disease, which

have been recently sent to me from Calcutta, and take advantage of the opportunity thus offered of bringing the subject before you. You will observe there are two specimens, which, in their present condition, after the action of spirit, present very much the same appearance, though they were very different while they yet formed part of the patients' bodies. One is the ordinary, the other the nævoid or lymphoid variety of the disease; and I shall explain the difference, which is of degree rather than kind. They were both removed from natives of India by Professor Partridge, in Calcutta, where the disease is exceedingly common; they appear to have been very small tumours, though excellent illustrations of the pathological anatomy of the disease. The larger specimen is one of the ordinary elephantiasis. It was removed from a Brahmin, aged thirty, a native of Calcutta. The tumour was of three years' growth, and weighed, after removal, 3 lbs. 4 ozs. The smaller is a good specimen of the lymphoid or nævoid form. It occurred also in a Hindoo in Calcutta, was of three years' growth, had been attended with irregular attacks of fever, and had yielded at times a copious discharge of milky, sometimes of sero-sanguinolent fluid, of which he had frequently relieved himself by tearing away a small portion of the integument. Both recovered after operation.

Such morbid growths have frequently been examined microscopically, and the result generally has been to show that though there is a great disturbance in the proportions of the histological elements, there is, after all, nothing really new—that, in fact, they are good examples of simple hypertrophy, which no doubt is significant of a constitutional disorder, the precise cause of which is at present obscure; though, from the prevalence of the disease in certain regions coincidently with certain conditions of climate, soil, and other influences, it is impossible not to suspect that the disease is in some measure dependent on these conditions.

Recently the discoveries of Lewis, Bancroft, Manson, Sonsino, Dos Santos, and Crevaux have thrown new light

on the etiology of this and other tropical diseases; and how far they seem to connect themselves with elephantiasis I shall presently relate to you. But first I must give you some account of the general pathology and symptomatology of the disease.

Elephantiasis has many synonyms: Bucnemia tropica; Morbus elephas; Elephantiasis Indica; Spargosis; Hernia carnosa; Phlegmasia Malabarica; Egyptian sarcocele; Barbadoes leg; Glandular disease of Barbadoes. In different parts of India, where I have studied it, it is known as Daool-fil (Arabic), Fil-pai (Persian), Hathi ka-paon (Hindostanee), Sleepatham (Sanscrit), Pee run-kaal (Tamul), Muntha-kaal (Malayalim), Mothakaaloo (Telugu), Kyagyee-gna (Burmese), and probably by other local names.

It is endemic in certain tropical and inter-tropical countries, generally near the coast, as Dr. Chevers, I think, said, where the malaria and sea air mingle. It is found in India, the Malayan Peninsula, China, Arabia, Egypt, the West Indies, parts of America, and probably, sporadically, all over the globe, perhaps excepting on extreme northern and southern regions.

Certain climatic conditions—humidity, heat, malarious influences, and proximity to the sea—seem to be concerned in causing it; it has frequently been observed that removal from the locality checks, whilst return to it reproduces the disease; and now, according to Lewis, Manson, Bancroft, and others, the presence of a filaria in the blood and lymph is considered to be largely concerned in the causation; at all events this parasite is frequently associated with, if not the cause of the disease. This is a subject on which more information must be obtained before a decided opinion can be expressed; but it cannot be denied that the causal relation of the nematode to elephantiasis and other morbid conditions, has some show of probability. The discovery by Dr. Manson that the mosquito, as an intermediary host, is instrumental in propagating the filaria, and consequently the disease, is also very interesting, and in both an etiological and sanitary point of view worthy of careful consideration;

but I think we can hardly yet regard this as established, and must wait until further observation shall have confirmed his views.

Elephantiasis may be defined as a non-contagious disease —at least it is so in the ordinary sense in which that term is used, though Manson's discovery of the part played by the mosquito in transferring the filaria would seem almost to raise a doubt of this—characterized by recurring febrile paroxysms, inflammation and progressive hypertrophy of the integument and the areolar tissue, occasionally by swelling of the lymphatic glands, enlargement and dilatation of the lymphatics, sometimes to such an extent as to give rise to a varicose distended appearance of the surface of the growth, in some cases by the co-existence of so-called chyluria and the presence in the blood and lymph of minute nematoid parasites; the hypertrophy of the integument causing enormous enlargement of the extremities, but especially of the scrotum, prepuce, or labia, sometimes of other portions of the integument. The greater tendency to hypertrophy in the genital organs, it would seem, is coincident with the larger supply of lymphatics to these than to other tissues. The bones of the extremity may even share in the hypertrophy. There is abundant albuminous deposit in the cells of the areolar tissue, and sooner or later degeneration of both muscular and osseous tissues.

It is totally distinct from leprosy (Elephantiasis Græcorum), with which, owing to its name, it is sometimes confounded. They are, however, unlike in symptoms as in nature, and have nothing in common, although it is to be noted that Mr. Vincent Richards ascertained that out of 636 cases collected by him in Orissa, 40 individuals, or 6·29 per cent., suffered from leprosy also, showing that the diseases may coexist.

It would be well to abandon elephantiasis as a generic name for true leprosy. Being derived from the supposed resemblance of the parts affected to the limb of an elephant, it is more appropriate to the disease which really does bear that character than to true leprosy. In reference to this,

Bateman says that the Arabic writers drew a distinction. They described bucnemia as *elephas*, and leprosy as *elephantia*; though here, again, it would seem that there was a confusion among terms by translators.

The ordinary form in which the disease occurs is hypertrophy of the integument and subjacent areolar tissue of some part of the body, notably of the legs and external genital organs; those parts most profusely supplied with lymphatics, apparently, being most affected. The skin becomes enormously thickened by hypertrophy of all the fibrous elements of its structure, which is attended by the deposit of a quantity of albuminous fluid in the areolar tissue. The papillæ in many cases become prominent, and much increased in size. The skin is formed into hard rugose masses or folds, not unlike the appearance of the skin of an elephant's leg, the feet and toes being sometimes almost hidden under it. The scrotum and labia form enormous outgrowths, often attaining great size and weight, accompanied by large hydroceles, the contents of which are often white, like milk or chyle, owing to exudation of lymph containing degenerated lymph-cells, or glistening with tubular crystals of cholesterine. From the male, tumours have been removed weighing upwards of 100 lbs. They vary in condition, according to the state of contractility of the muscular elements. At times they are densely firm, at others they are flaccid and soft. In certain cases there is a highly hypertrophied and dilated condition of the lymphatics, especially near the surface; they are prominent, turgid, soft, elastic, or fluctuating, while during the periods of febrile excitement, they are so turgid as sometimes to rupture, discharging a chyloid fluid, giving rise to a sort of varicose or nævoid condition. The cells and ampullæ, when punctured, give exit to a quantity of lymphy fluid, sometimes clear, sometimes whitish or pinkish, which coagulates firmly after removal, in which are found the filaria of Lewis, and the loss of which causes great exhaustion. In some cases where this distinctly varicose or nævoid form is not assumed, the surface of the outgrowths, during the periodic

febrile attacks, assumes a herpetic condition, with an acrid and offensive serous exudation.

Now these outgrowths, though they are very interesting as such, are still more so as evidences of a constitutional disease, the result of certain climatic causes, the nature of which is not yet understood; although, considering its geographical distribution, it seems probable that whatever else—filariæ or other agent—may be at work, the so-called malarious influences play an important part in its production. The discovery of the existence of nematodes in the blood, and that chyluria and hæmatozoa are frequently, if not always, associated with elephantiasis, is not only suggestive of a common origin of these diseases, but also of other hitherto imperfectly understood tropical cachexiæ. The ordinary form of elephantoid hypertrophy may occur independently of chyluria, hæmatozoa, or of any *obvious* change in the lymphatics. But it is to be remembered that the hæmatozoa are very difficult to detect.

I think it is desirable, whilst fully recognizing that hypertrophy from lymphangitis may occur in other conditions, to limit the term "elephantiasis" to the constitutional form of disease that is found within certain geographical endemic areas, and is manifested by periodic paroxysmal recurrences of fever, accompanied by the disturbed state of the lymphatic system, the progressive hypertrophy, and sometimes by hæmatozoa, I have already described. There are cases of hypertrophy of the skin with dilated lymphatics, and occasional constitutional disturbance, that may be and are described as elephantiasis, which occur here as they do elsewhere, but I do not think they are identical with, though very similar to, the true elephantiasis as it is seen in tropical or inter-tropical climates.

Elephantiasis affects both sexes and all ages. No race is altogether exempt, but the dark skinned seem more liable to suffer than the fair. Men suffer in a larger proportion than women. Waring says that of 945 cases observed in Travancore 716 were males, or 75·76 per cent.; 229 were females, or 24·34 per cent.—or about 3·5 males to 1 female; pre-

judices against submitting women to examination may, however, account in some measure for the disproportion. It is most common in adults, and is very rare in children or beginning in aged persons, though it has been seen in infancy and in old age. The period of life between twenty and forty is that most prone to be affected. V. Richards, who carefully studied the disease in Bengal, thinks that hereditary predisposition is a cause; of 236 persons affected, 193, or 73 per cent., had one or both parents suffering from the disease.

The malady is not always attended by obvious disturbance of the general health during the intervals of the febrile attacks, which in some instances are few and slight. The appetite, spirits, and general condition are good, the functions normal, and the only inconvenience is the size and weight of the outgrowth, though, frequently, the rapidly-recurring febrile attacks, pain, exhaustion, suffering, and visceral complications induce cachexia and debility so serious as to render even surgical interference impossible. Hepatic and splenic complications do not, as a rule, result from the persistence of elephantoid fever alone, but they not unfrequently result from malarious poisoning, and seriously aggravate the evil. Albuminuria and chyluria may be present in some cases. After the outgrowth has attained a certain size, it ceases to grow, or increases slowly, insidiously, and without febrile disturbance, the health being generally good, though there will probably be a recurrence of fever once or twice a month, when the parts become hot, tense, painful, swollen, and often discharge a serous or lymph-like fluid, which may be acrid and offensive. Some tumours, however, seem but slightly affected, and remain perfectly dry. But in all cases the growth progresses, and even when, as occasionally happens, fever ceases to recur, there may still be a slow and painless increase of the tumour. Sometimes it is very rapid, at others it is slower, with intermissions of activity and indolence. According to Richards, the average duration of the disease, as deduced from the observation of 636 cases,

was eleven years and a half; the earliest age was nine years, the latest at which he observed it was eighty years of age. It appears that the disease does not of necessity shorten life, though no doubt—especially when there is splenic or hepatic complication, diabetes, or albuminuria—dangerous ulceration and even gangrene may supervene.

In some cases there is reason to believe that debility and cachexia, as well as the disease itself, interfere with the procreative power. But men who had long been incapacitated have become fathers after removal of the outgrowth; and there is no reason to conclude that the disease, unless it cause great debility, is necessarily attended by loss of generative power in either sex, though it would seem that women have a tendency to abort when they are affected.

Various causes are assigned for the disease in the regions where it prevails. Air, water, food, and, as it is frequent near the sea coast, eating fish, have been credited with it; the vicinity of certain forms of vegetation, geological formation of soil, have each or all been regarded as causes. Climate and locality, some undefined endemic influence, combined with poor living, are doubtless predisposing causes, and it is probable that, like some other cachectic conditions observed in tropical climates, it may be determined by the presence of filariæ in the nutritive fluids. It is interesting to learn that Dr. Manson, in China, considers that the geographical distribution of elephantiasis is much the same as that of the mosquito; indeed, he and Dr. Bancroft attach much importance to the *rôle* played by these insects as intermediary hosts and propagators of filariæ, and the disease. I have already mentioned the important discovery by Dr. T. Lewis of the existence of the embryos of the filaria in human blood, and it is impossible not to recognize the important bearing that his researches may have on their relation to elephantiasis, chyluria, and other disordered states of the lymphatic system. Further investigation may confirm or it may reject these views, but one cannot but recognize the importance of the discoveries, though their precise import in relation to elephantiasis is still *sub judice*.

Dr. A. Webb believed that in some cases the disease had a syphilitic origin, but this view has not met with much support from others, nor is it based on any very positive evidence. As to its origin, it is to be noted that whilst the disease occurs in malarious regions, it is not always more prevalent where paludal fevers are most severe, and though frequently associated, is not identical with malarious fever. It is probable that its occurrence, like that of dysentery, goître, and other forms of disease, may be determined in some way by the causes that give rise to intermittent fever, splenic cachexia, neuralgia, etc., and which in our ignorance of their real nature, we call malaria! The subjects of the disease in India are under the impression that it is caused by lunar influences, and have the firmest conviction that the paroxysms of fever and inflammation are due to, and synchronous with, lunar changes; and as it no doubt frequently happens that the fits do occur at the same time as the changes of the moon, it is not strange that the natives should hold a belief, which is almost universal in regard to the influence of the moon on other vital conditions, and by no means always confined to the ignorant. Such, however, is the case, and in many cases you might as well try to convince the person that he had no disease at all, as that it was not so determined.

No race, as far as I know, is exempt from the disease, but whatever may be the explanation—perhaps it may be in better living, less exposure to the causes—the white appears to be less subject to it than the dark races. It does occur occasionally, though very rarely—I have seen it twice only—in the pure European in India; more frequently in those of mixed races, and it will generally be found that when it occurs in persons of European parentage, there is a mixture, however slight, of dark blood. Waring says that the lower animals are not exempt; even birds have been known to suffer from a swelling of one or both legs, which, though unaccompanied by fever, was in all respects similar to the hypertrophy of elephantiasis.

The disease occurs in different forms and in various degrees

of severity. In some, the attacks of pain are of repeated recurrence, from intervals of a fortnight to a month, the increase of the hypertrophy being rapid; in others they are irregular, slight in intensity, whilst the growth of the tumour is slow and less pronounced. Long intervals of quiescence, varied by occasional increase of the swelling with very little fever occasionally occur. In some cases, the growth is slow and continuous, without *any* disturbance of the general health. The hypertrophy appears to be simply an increase in the natural histological elements, the structural changes being most marked in the outset in the lymphatic tissue, and the hypertrophy progressing most rapidly and conspicuously in parts like the scrotum, labia, or certain portions of the integument where lymphatics most abound. That this is the determining cause of more growth in one locality than another, I think is pretty certain. In some examples—those which I described as nævoid elephantiasis, Dr. Vandyke Carter as lymphatic varix—the lymphatics and lymph spaces undergo great hypertrophy and dilatation, giving rise to a soft, elastic, spongy, varicose condition, which, when punctured, gives exit to a quantity of whitish or pinkish fluid, like that of so-called chyluria, which, of course, is not *chyle*, but lymph, whitened by fatty degenerate lymph-cells, or reddened by blood-cells, coagulates firmly on removal, and exhausts the patient just as the loss of so much blood would exhaust him. The lymphatic glands share in the enlargement. In other respects the progress of this is like that of the ordinary form of the disease, and it is the same, or nearly the same, in structure. Hydrocele is one of the earliest symptoms, and nearly always accompanies elephantiasis. Inflammation of the lymphatics of the cord is also a frequent initiatory process.

In Europe and in India we also see cases in which lymphangitis and hypertrophy takes place with a dilated varicose state of the lymphatics and glands, occasional fits of excitement, increase of temperature, and discharge of *chyle-like* fluid, the loss of which is very exhausting. These resemble, but are not really, true elephantiasis.

Mr. D'Arcy Power has made a careful microscopical examination of these specimens. The larger tumour did not show any material change in the epidermis, but great thickening of the subcutaneous connective tissue, which was pervaded by numerous bands of unstriped muscular fibre dispersed transversely and vertically, as well as numerous free nuclei. The tissue was compact, and mainly destitute of fat; the hairs and their follicles normal; sweat-glands of large size; blood-vessels numerous and large, and the lymphatic channels dilated and abundant. The smaller tumour also showed considerable hypertrophy of the subcutaneous connective tissue, and hypertrophy of the hair-follicles, sebaceous and sweat glands. The blood-vessels and lymphatic channels were large, the latter containing numerous small refracting angular bodies, staining deeply by reagent. The specimens were carefully examined for filariæ by Mr. Henry Power, Dr. Cobbold, and Mr. Macnamara, who had also seen them. It was suggested that the numerous small semi-circular bodies, about the diameter of red blood-corpuscles, met with in the second case in the lymphatic channels, might be transverse sections of filariæ. If so, the number of these organisms present must be very large.

But little impression has yet been made on this disease by constitutional treatment; remedies though useful during the febrile paroxysms in moderating their severity and the excess of local action, have little power in preventing recurrence or in checking its onward progress. Preparations of iodine in combination with quinine, arsenic, and iron, have all been found useful to a certain extent. During the fever, salines, diaphoretics, aperients, and such remedies as are useful during the pyrexial stages of malarious fever, are indicated. The internal use of opium in some form may be necessary to relieve the intense pain which often accompanies the onset of the stage of excitement, when the suffering in the spermatic cords, testes, and generally in the lumbar regions is sometimes so intense, combined with the depression caused by nausea and retching, as almost to prostrate the patient from exhaustion.

The local application of iodine or some of its preparations, by inunction or otherwise, of such forms as the iodide of lead or the biniodide of mercury, have been thought to be useful; but as they are generally applied in conjunction with pressure when the patient is kept in a recumbent posture, the benefit is probably quite as much, if not more, due to the mechanical action of posture and pressure, as to drugs.

A due combination of local and constitutional remedies, with rest, improved diet, and improved hygienic conditions, may, and no doubt do, somewhat control the progress of the disease and relieve suffering; no remedy, however, is so potent as change of climate. This, if effected in the earliest stages, may completely arrest the disease, and, perhaps, but this is doubtful, even disperse any incipient structural change that may have occurred.

It has occasionally been observed in the rare cases in which it affects Europeans, that returning to Europe, they have, after a time, lost the disease, and almost, if not entirely, any hypertrophic changes that may have occurred. Natives of India improve, and the disease often ceases to progress, if they leave the endemic area during the early stages, to go and reside in other and drier localities. Such a change, for example, as from Calcutta to Delhi, in the case of a native of Bengal who is affected, is often effective in arresting, if not in curing, the disease. It is constantly observed, however, that after the hypertrophic condition has become advanced, the paroxysms of fever are still liable to recur, even when the climate is changed, though they do so with less violence, showing that the tumour itself acts in some way as a source of dyscrasia that perpetuates the recurrence of the febrile state, which ceases altogether after the growth has been removed. This, where the disease affects the genital organs, is practicable. When the limbs are the seat of disease, it is not so.

The onset of elephantiasis is frequently attended with great suffering. There is high fever, intense pain in the lumbar region, the groins, the spermatic cords and testes, which become much congested and swollen, whilst acute

hydroceles form. This is often accompanied by sympathetic vomiting, nausea, rapid and erythematous swelling of the external parts; and if the extremities be attacked, the swelling is frequently very tense and painful, accompanied by much effusion into the areolar tissue. The surface of the integument is much inflamed, and sometimes discharges a serous ichor or chyle-like fluid, according to the extent to which the lymphatics are engaged in the particular case. There is much constitutional disturbance, increase of temperature, and often depressing nausea and vomiting especially when the cords and epididymus are implicated; whilst the great tension and swelling of the cords is apt to dilate the abdominal rings so widely that, after they subside, the patient is liable to suffer from hernia through the widened inguinal passages.

During the fever and excitement, salines and aperients, with soothing local applications, fomentations, and often opiates, are necessary to relieve pain and give rest. When this stage has passed, quinine is useful, which if anæmia exist should be combined with iron, which may be all the more necessary if other indications of malarial cachexia be present. Many tonics have been recommended, but there is no reason to believe that, beyond their general action as tonics, antipyretics, or febrifuges, drugs have any special action on the disease. Richards thinks that he has seen benefit result from confining certain natives of Orissa to a milk diet! but it is to be feared that even this simple form of treatment will not generally succeed.

It is impossible to over-estimate the importance and value of change of climate; in the case of Europeans this should be to Europe, in that of natives of India to a district where the disease does not prevail—beyond damp and malaria as much as possible; and in addition, all measures should be resorted to that can tend to improve the general health and impoverished condition of the blood.

Surgical treatment, when the hypertrophy is advanced, is often most successful in relieving the sufferer not only of the outgrowth, but also of the fever, which ceases when the

tumour is removed, for it would seem that it acts as a source of dyscrasia keeping up recurrences of fever whilst it remains.

Tumours of the genital organs, sometimes of enormous size, are now removed with complete success, and considering the formidable character of the operation and the magnitude of the mass—which has occasionally exceeded 100 lb. in the male—with comparatively small mortality.

The removal of a scrotal tumour is effected by incisions along the course of the cords and the dorsum penis. The cords, testicles, and penis are turned out by a few touches of the knife, then reflected and held up on the abdomen, while the mass of the tumour is rapidly swept away by a few bold incisions in the perineum. The removal should not occupy more than three or four minutes, unless any complication should arise from adhesion of the testes to cicatrices, which are often caused by the application of the moxa, a favourite native method of treating the disease in its early stages. The numerous venous and arterial bleeding points should then be arrested by ligature or torsion, and the surface of the wound dressed antiseptically.

No attempt should be made to preserve flaps of integument, which are unnecessary, and almost certain to be the seat of recurrence of the disease. In from two to four months all is closed in by cicatrix-tissue, which gradually perfects itself, and is not liable to become the seat of recurrence of the disease.

Before commencing the operation, especially in the case of a large scrotal tumour, it is well to drain it of blood by placing the patient on his back, elevating the tumour on to the abdomen for an hour or so before the operation, during which time pressure by a bandage, a modification of Esmarch's, may be tried, and ice may be applied. During the operation the application of a whipcord ligature drawn tightly round the neck of the tumour prevents loss of blood, and it is very important that as little blood as possible should be lost from the numerous bleeding points, which

are seldom controlled with fewer than twenty to thirty ligatures, often more. The shock of the removal of so large a mass is frequently so severe as to cause anxiety. In such cases the patient should not be moved until reaction has thoroughly set in, and care should be taken no hæmorrhage occurs from small vessels, which during the operation may have escaped notice.

The subsequent dressing of the wound must be conducted with care and attention, pressure being judiciously applied as the testes close in by the rapidly contracting cicatrix. During the first forty-eight hours it is better not to interfere with the dressings, as up to that time, and even later, they are completely glued to the surface of the wound by the lymph which is exuded. The dressings can then be changed without much trouble to the patient, or fear of causing hæmorrhage. The subsequent applications should consist simply of lint, with carbolized solutions; and as the wound closes, it may be necessary occasionally to aid contraction by strips of adhesive plaster. A weak solution of chloride of zinc, carbolic acid, or other antiseptic, should be frequently sprinkled over the dressings to destroy the fætor of the discharges, which, during the hot weather—the thermometer at 90° in the shade—decompose very rapidly. The elongated cords rapidly contract, and in the course of three or four weeks, the testes, which were dependent half-way down to the knee, are drawn up, and begin to be enclosed within cicatrix-tissue.

The constitutional treatment, for the first few days, when there is feverish excitement, requires salines and restricted diet; but the necessity for more nourishment soon arises, as the patient requires a plentiful supply to repair the loss caused by the profuse drain. The periodical paroxysms of fever which accompany the growth of the tumour disappear after the operation, and the relief afforded to the sufferer is great.

In thin persons the abdominal tourniquet may be applied.

The process of healing occupies from two to four months, but when complete is very satisfactory. The genital organs

are covered and protected, and the relief to the sufferer, who had for years been encumbered with a tumour of perhaps thirty to sixty pounds' weight, may be imagined. The procreative powers are frequently restored. Of 193 cases of scrotal elephantiasis operated on in the Medical College Hospital in Calcutta between 1849 and 1871, thirty-five, or 18·2 per cent., proved fatal, the causes of death being pyæmia, embolism, obstruction of the pulmonary arteries, diarrhœa, tetanus, shock. Some of the deaths were traceable to insanitary local conditions, and probably might not have occurred under more favourable circumstances.

The tumours removed varied in weight from two or three pounds to one hundred and ten pounds. The ages of the patients ranged from twenty to over fifty years. It is to be observed that the recorded weight of the tumours is that of their solid parts, after the blood and fluid had drained away, and does not include the fluid of the hydroceles, which in some cases adds much to both weight and bulk.

The vermicular movements of the tumours, which continue for some time after their removal, are very remarkable—the contraction being, in some instances, so well marked as to cause distinct movement of the entire mass; illustrating remarkably the contractile action of the dartoid structure.

It has been suggested by high authority that elephantiasis of the limbs may be advantageously treated by ligature of the main artery, but it is difficult to understand on what physiological principle this mere temporary starvation of the limb should have any efficacy in removing the local expression of a constitutional disease. That it might temporarily ameliorate it there is no reason to doubt, but the same effect would be produced by pressure on the limb or its artery, or by continuance in the recumbent posture; such, indeed, has been the result in certain cases in India. Ligature of the femoral artery, which was necessarily accompanied by protracted rest in bed, the application of bandages, and the general diminution in size that would follow pressure, caused considerable reduction in the size of the leg. The

improvement, however, was temporary, and the disease returned to its original dimensions when the patient resumed his usual mode of life.

It does not appear to me that there is sufficient ground for expecting permanent improvement in a case of true elephantiasis from merely temporarily arresting the flow of blood, and subsequently altering its channel of distribution in the limb through the anastomotic circulation, to warrant ligature of the main artery: and, as I have stated, ligature of the femoral artery for elephantiasis of the leg failed, in Calcutta, to produce any permanently good result, it is so far neither supported nor confirmed by experiment.

ON THE RELATION OF FILARIA SANGUINIS HOMINIS TO THE ENDEMIC DISEASES OF INDIA.

Epidemiological Society, February 5th, 1879.

In March, 1870, Dr. T. R. Lewis, of H.M.'s British Medical Service, made known his discovery of certain microscopic nematodes in chylous urine, and suggested their probable causal relation to that disordered state of the lymphatic system. In the Appendix to the Sixth Annual Report of the Sanitary Commissioner with the Government of India in 1869, published in Calcutta in 1870, he states that when examining the urine of a patient, in Calcutta, suffering from chyluria, he discovered, amidst the fibro-albuminous matter in that fluid, the embryos of a new round worm each time he repeated the examination, and noticed appearances that indicated the existence of a sheath in which it was enclosed. He, at first, thought that what he saw were detached filaments of a fungus, but movements revealed their real nature.

As to their size, considering that 200 could pass abreast through a pin-hole, an orifice not exceeding one-fiftieth of an inch in diameter, it is not surprising that their existence had not been suspected. Lewis probably was not then aware that they had been seen, under similar circumstances, by Wucherer, in Bahia, in 1866.

This appears to be the earliest notice of their existence in India, and certainly it was an original discovery of the

greatest importance in its bearing on hitherto unsuspected causes of certain diseases. In July, 1872, when examining the blood of a native in the Calcutta Medical College Hospital, who was suffering from diarrhœa, Lewis detected nine nematoid worms, in a state of great activity, on a single slide. They were similar to those observed in chylous urine in March, 1870. Specimens were sent to Dr. Parkes, who, with Mr. Busk, expressed an opinion that they belonged to Filaria. It had not hitherto been known that they were *hæmatozoa*. The name *Filaria sanguinis hominis* was given to them. Further examination of cases of chyluria proved that both in the blood and urine the filariæ were to be found, as also in morbid secretions. For example, in a case where chyluria was associated with granular eyelids and inflammation of the eyes, giving rise to a milky secretion from the corners of the eyelids, filariæ were detected in the exudation. Lewis gives a rough estimate of the number of filariæ at 140,000, being an allowance of two individuals in each drop of the ten pounds of blood possessed by a person of one hundred pounds weight. This—if the parasites pervade the whole blood, as they probably do—is, I should think, considerably below the mark!

The creature is very minute, and apt to be overlooked without long, careful, and patient examination. The power employed should be sufficiently high to define a red blood-globule. The diameter of Filaria sanguinis hominis is about $\frac{1}{3500}$ inch—some are larger, some smaller: the largest $\frac{1}{3000}$ by $\frac{1}{68}$; the smallest $\frac{1}{7000}$ by $\frac{1}{125}$. Filaria sanguinis hominis belongs to a family that includes many other entozoa prejudicial to man and animals—Ascaris, Oxyuris, Dochmius, Speiropetera, Anguillula (the diarrhœa worm of Cochin China), Dracunculus, Trichinæ. It is allied to the last-mentioned, and their larval forms are somewhat alike, though perfectly distinguishable. During the first few hours "after removal from the body, the filaria is in constant motion, coiling and uncoiling itself, and lashing the blood-corpuscles about in all directions." It has the power of retracting the head and tail. When recent it is smooth and translucent; some have

a granular appearance. A spot like an oral aperture sometimes appears. As they become inactive they lose their transparency; if a little spirit be added they preserve their outline, but otherwise quickly disappear. They are capable of retracting within the delicate sheath by which they are surrounded. Under careful examination, an oral and an anal aperture and an intestinal tube can be made out.

The embryo being enclosed in a sheath, and having no visible boring apparatus, we may assume that its home is in the blood or lymph, and that its movements are those of the circulation. With regard to the part taken by it in the production of disease, post-mortem evidence is much needed, not only with the view of determining what pathological changes take place, but of ascertaining the seat of the parent worm, and especially should search be made in and near the blood and lymph channels. Lewis describes the post-mortem appearances in the kidney. "It was more than usually lobulated, and on section several of the pyramids, especially near their apices, presented a smooth, tallowy appearance, suggestive of amyloid disease; no approach to the characteristic iodine reaction, however, was obtained. Translucent oil-like tubules of a varicose appearance were observed alongside of the uriniferous tubes, as if the vessels had been plugged: boiling ether had no effect on them. No other morbid changes were found, but, in every part of the kidney examined, filariæ were found, as also in the branches of the renal artery, which were not, however, enlarged." The capillary vessels, from the absence of good preparations, were not examined. Worms of various sizes were found in the chylous urine, but no casts.

Chyluria is frequently associated with symptoms of other obscure diseases—diarrhœa, often of a persistent character, deafness, chronic ophthalmia. And here I may notice that in horses*, and men† too, in Africa and India, a filaria is occasionally found in the eyeball. I have several times seen horses blind from the presence of a living and moving nematode in the anterior chamber, which quickly induces corneal

* Filaria papilosa. † F Loa.

opacity. There are several other morbid conditions that I shall presently refer to.

The chyluria, due probably to the stoppage and rupture of lymphatic vessels, is doubtless very frequently associated with filaria; but we may not, I think, affirm that it is *always* so caused—other conditions may give rise to it; but in warm countries, or in the case of persons who have long resided there, it is important to consider their possible origin, not only as regards chyluria, but in chronic diarrhœa, especially if associated with intermittent chyluria. It has been shown that the parasite may live for years without causing any very palpable derangement of health; and that it does not undergo any development as long as it remains in the circulation. It may continue an abiding source of disease, which, under certain conditions, will develope itself; what these conditions are we now seek to learn.

Others, besides Lewis, share the honour of the discovery. The literature of the subject is already extensive, and I can only refer to some of those who have contributed to it. Dr. Cobbold, who has himself added so largely to our knowledge on everything connected with helminthology, gives a list of authors.

In 1843, Klenke found worms in the blood of a person suffering from vertigo, but as he did not describe them exactly, their precise nature is unknown.

In 1866 or 1868, the late Dr. Wucherer, of Bahia, published an account of a worm that he had detected in the urine of a person suffering from hæmato-chyluria—he found it when searching for Bilharzia—and describes the minute nematode as narrow at one, obtuse at the other extremity. He found it on subsequent examinations of chyluria, and always alive and active.

In 1868, Dr. Salisbury, in the United States, discovered a small entozoon in the bladder of a chylurious person. He described it as a new form, and called it Trichina cystica.

In July, 1870, Dr. Cobbold, F.R.S., found a minute

nematode and eggs in the urine of a little girl from Natal who was suffering from Bilharzia. He says that, though numbers of fluke's eggs were passed daily with much blood, it never occurred to him that the nematode was a hæmatozoon. The child's parents some time previously told him that she had passed three small worms by the urethra, and he assumed that they were of urinary origin. Had he, as he remarks, examined the blood from a finger, Lewis's important discovery of microscopic hæmatozoa might have been anticipated.

In or about 1872 several "finds" were made in foreign countries. I cannot detail them, but they may be found in Dr. Cobbold's interesting paper in the "Proceedings of the Linnæan Society" (October, 1878, vol. xiv., No. 76); and in a paper in the *Veterinarian*, a translation of a memoir by Da Silva Lima, with appendix by Le Roi de Méricour; also in the August and September numbers of "Archives de Médicine Navale," by Bourel Ronciere.

Up to 1872 the discoveries related only to the urine. In July, 1872, however, Lewis discovered the nematode in the blood, under circumstances already described, in a case of diarrhœa, and in the following October in that of a formerly chylurious person. The worms were identical. This very important discovery of the *blood stage* is, therefore, Lewis's; although the embryo had been discovered some time previously in the urine, by Wucherer.

The parent worm was discovered still later by Dr. Bancroft in Australia. Thus we have separate discoveries of the different phases of filaria from widely distant quarters of the globe.

Dr. Manson, in China, ascertained that the mosquito is its intermediary host. To all much credit is due; and whether we call the parasite *F. Wucherii*, *F. Sanguinis hominis* (Lewis), or *F. Bancroftii*, is unimportant. If the blood stage, which is by no means certain, be the most important phase of its genetic cycle, we may, perhaps with advantage, retain the Indian name; if the parent be the cause of most mischief, which may prove to be the case,

then perhaps *Bancroftii* will be the most appropriate specific distinction. In any case, to each of these gentlemen is due the honour of a most important discovery.

To revert to the embryo: in 1874 Dr. Sonsino, in Egypt, when examining the blood of a young Egyptian Jew suffering from Bilharzia hæmaturia, detected a minute filarial embryo, which he was good enough to demonstrate to me in Cairo when I was there in 1876. I wrote a notice of it in the *Lancet* as Filaria sanguinis hominis Egyptiaca. It seemed probable that it was a variety; but there is, I believe, no doubt that it is identical with Lewis's species. Sonsino has also discovered a filaria embryo in the blood of the horse, and in that of the crow.

In 1875, Dr. O'Neill, in the South Coast of Africa, found embryo nematodes in the exudation from the skin in a disease named by the negroes *Craw-craw;* whilst Dr. Aranjo detected it at Bahia, in a negro suffering from the same disease. He called it Filaria dermithemica. F. Dos-Santos found it, *once only*, in the blood of a person suffering from elephantiasis in Bahia. Dr. Crevaux detected it in chyluria in Guadaloupe.

Certain free microscopic nematodes very closely resembling, if not identical, have been found in the potable waters of Rio-Aqua di Carioca by Dr. Magalhaes. Their genetic relation with Filaria sanguinis hominis is not, I believe, quite established, but the indication is important, as it points to the channel through which the parasite may find entrance to the human body.

Dr. Manson, of Amoy, has discovered—what had been already suggested by Dr. Bancroft in Australia—that the hæmatozoa are transferred to the stomach of the mosquito, and he has described the transformation they there undergo. A new and important *rôle* for this already obnoxious insect has thus been revealed, the *full* import of which remains still to be ascertained. It appears that the mosquito has a peculiar facility for ingesting filariæ, as the blood taken from their stomachs contains more parasites than that taken directly from the person they have fed on. Manson says,

that the embryo, after entering the mosquito's stomach, retains for a short time the appearances which characterize it in the human blood. But after a few hours, changes begin; a double outline of body, and marked striation, appear and again disappear. This is the first stage in metamorphosis, and occupies about thirty-six hours. It now enters on a sort of chrysalis condition, in which, though quiescent, it changes in form—its four-lipped mouth and an intestinal tract become apparent about the fourth or fifth day. The subsequent details are difficult to trace, but it is one-fortieth to one-thirtieth of an inch in length; it now completes the mosquito-phase, and is very active, "moving about with great facility and rapidity in the water, into which it has emerged equipped for independent life."

Lewis also found the embryo in mosquitos in Calcutta, and has described them in the *Bengal Asiatic Society's Journal*, of March, 1878. He says that most of them came from pariah dogs, and they very closely resembled the human parasite. But he says that the mosquitos captured in a particular servant's house did contain human filariæ, and that he had the opportunity of observing all the stages of their growth; that whilst the stomach digests some, others perforate its walls, pass out, and undergo developmental changes in the thoracic and abdominal tissues of the insect. He thinks it will be found that Manson's observations apply to India, but does not feel convinced that the mosquito is *the* only intermediary host; it may turn out to be so, but it is to be noted that even the most advanced stage hitherto seen is still a very immature one, no trace of reproductive organs being distinguishable.

Dr. Cobbold thinks we have sufficient information to establish the genetic relationship between Filaria sanguinis hominis, the stomachal filaria of mosquito, and the sexually mature Filaria Bancroftii. This name is given by Dr. Cobbold to the mature worm, in honour of its discoverer, who first found it in Australia in 1876. He sent specimens home, and they were verified by Drs. Cobbold and Roberts. Dr. Cobbold having detected, among specimens of microscopic

hæmatozoa sent home by Bancroft, a single empty egg-covering, which corresponded with some he had observed in a Natal patient, suggested search for the parent; and Bancroft found it, in a person suffering from lymphatic abscess of the arm, in December, 1876. Lewis made further search, and on August 7th, 1877, found two specimens in the blood-clot from a young Bengali lad who had been operated on for nævoid elephantiasis. Carter, in India, in 1876, had also found it in a lymphatic abscess of the arm, and in hydrocele of spermatic cord. Drs. Aranjo and F. Dos-Santos and others also verified the discovery. Bancroft sent specimens to Dr. Cobbold, who gave an account of their anatomy in the *Lancet* of October, 1877, with figures. He only found the female, and gives the following dimensions:—Mature—length, $3\frac{1}{2}$ in.; breadth, 1″. Embryo—length, $\frac{1}{200}$th to $\frac{1}{125}$; breadth, $\frac{1}{3000}$ to $\frac{1}{2500}$. "Body capillary, smooth, uniform in thickness; head with a simple circular mouth, destitute of papillæ; neck narrow, about one-third of the width of the body. Tail of female simple, bluntly pointed. Reproductive outlet close to the head; anus immediately above the tip of the tail. A number of ova and embryos escaped from a mature worm during examination."

Lewis also gave a description and figures in the *Lancet* of September 19th, 1878, which very closely corresponds with that by Dr. Cobbold, and says, "It is possible that when the parasite discovered by Dr. Bancroft has been more definitely described, and its anatomy investigated, it may become evident that it is identical with the Filaria sanguinis hominis." Of this I imagine there is now little, if any, doubt I should add that Lewis noticed that the embryos which escaped from the mature worm detected in the blood-clot of nævoid elephantiasis were identical with embryos found in the blood of other parts of the body.

As regards the mode of entry into the human body, Manson says, speaking of the embryo *after* it has left the mosquito and escaped into water, "It is through this medium brought into contact with the tissues of man, and thus, either by piercing the integuments, or, what is more probable,

being swallowed, it works its way through the alimentary canal to its final resting-place; arrived there, its development is perfected, fecundation is effected, and finally the embryo filariæ we meet with in the blood are discharged in successive swarms, and in countless numbers. In this way the genetic cycle is completed." With regard to a boring apparatus, Manson says, "I cannot say if the three or four papillæ round one extremity of the developed embryo constitute the perfected boring apparatus of the worm, or if it is a boring apparatus at all; but comparing this with what is found in other species, I think it very probable that it either is or will become the piercing apparatus."

I may not dwell longer on these details: they will be found in full in Dr. Manson's paper in the *Linnæan Society's Journal*, No. 75, vol xiv.

I would remark that whilst this is probably the right interpretation of what takes place, it cannot be regarded as perfectly established until further observation shall have confirmed the facts.

This much, however, may be regarded as certain:—The embryo filariæ may swarm in the blood, and be associated with, or give rise to, certain morbid conditions. They pass into the mosquito, or it may be into other intermediary hosts, where they undergo developmental changes in the tissues of the insect, and are at length set free in the water along with the larvæ. We cannot actually trace them further, as they pass into man, but we have good grounds for believing that they do so, through the medium of water. Nor can we follow them through the further developmental changes that result in sexual maturity; though we know that the fully developed worm finds its home in the tissues of man, and then sheds its embryos into the circulating blood.* How much, and in what proportion, the diseased conditions that result from their presence are due to the embryo, or how much to the

* Dr. Thin informs me that they have since been found in the lymphatics, by Dr. Manson, in China. He showed a specimen of a female parent Filaria sanguinis hominis, in a dilated lymphatic from a lymph scrotum, from China, which is now in the Hunterian Museum.

parent worm, we are still unable to say; but we have good ground for believing that post-mortem examinations will now throw light on the subject, as well as on the precise localization of the parent worm.

It is not within the scope of this paper to describe the diseases due to nematodes generally; I must restrict my remarks to those ascribed to Filaria sanguinis hominis.

Great advance has been made in our knowledge of this subject during the last four or five years, in reference to the relation of this parasite to certain forms of tropical disease. It has been shown that disorders of the lymphatic system are most frequently associated with, if not caused by, Filaria: nævoid and ordinary elephantiasis Arabum, *perhaps* also elephantiasis Græcorum,* chyluria, hæmaturia, hydrocele and affections of the cord and testis, lymph-varix and abscess, diarrhœa, fever, cachexia, deterioration of general health, certain skin diseases (Craw-craw), deafness, eye disease—all these have been ascribed to, though it is not asserted that they are *always* caused by it. Being symptoms of impaired or impeded function, they may be produced otherwise; but it is tolerably certain that we have now got one explanation of their origin in a hitherto unsuspected agency. The mechanical action, were there no other effect, might explain much that occurs by the plugging and obstruction of the nutritive channels. To say nothing of the direct effects on the blood itself, one can hardly conceive that these organisms should exist in that medium, in any numbers, without affecting it prejudicially, though we know that they have been found in the blood of persons who were apparently healthy. Of course, it is difficult to define any absolute standard of perfect health; and there may be a considerable amount of cachexia, even in persons generally regarded as healthy, who, perhaps, could we know their real condition, we

* Dr. Bancroft has recently written to Dr. Cobbold that he had found filariæ in the blood taken from anæsthetic patches on the thigh of a European, aged forty-nine, in Brisbane, suffering from leprosy. Dr. Bancroft also says that he has examined the blood of two patients who formerly had filariæ associated with abscess of the arm; their blood is now free from hæmatozoa.—*Lancet*, February 1st, 1879.

might think otherwise. What the peculiar change in locality or action on the part of the hæmatozoon may be that determines the diseased condition, is one of the points that needs elucidation.

We naturally ask if there be any analogy in the conduct of other entozoa in this respect? Dracunculus may cause little or no annoyance in the earlier stages, but developing, changing place, and discharging its embryos, the gravest results follow. Trichina in its earlier stages is comparatively unfelt, but may become the cause of fatal disease.

When the blood swarms with minute organisms, one might expect to find some evidence of their presence, either in mechanical interference with the blood or lymph circulation, or from *direct action on the blood itself*, or on the nerve-centres. Of the first we have an example in lymph-scrotum, elephantiasis, and chyluria. Of the second, I believe it is probable that several morbid states hitherto ascribed to other causes may be due. We know how severely animals suffer from the presence in the blood of other minute organisms. Anthrax, for example, is produced by Bacillus; a cholera-like disease in pigs is produced by the migration of Stephanurus, as pointed out by Dr. Cobbold; phthisis in sheep by Strongylus filaria; and in man, as shown by Griesinger, the so-called and widely spread Egyptian chlorosis owes its origin to Dochmius duodenalis (Leukhart), whilst not only anæmia, but liver disease and a form of dysentery, are produced by the same parasite, which is not very unlike Filaria sanguinis hominis. "Similar facts," says De Chaumont, "have been observed in Brazil, Arabia, Madagascar: it seems impossible but that in India the formidable affections caused by the Dochmius should be common."

Manson and Lewis have shown that certain filariæ (*F. sanguinolenta* and *F. immitis*) infest dogs in China and India; they very closely resemble the human parasite, and give rise to certain diseases. Sonsino has demonstrated filariæ in the horse and crow in Egypt. In July, 1872, Lewis found in the exudation pressed out from the mesenteric glands of a pariah dog, in Bengal, a small embryo nematode that very

closely resembled the Filaria sanguinis hominis, and corresponding to Filaria sanguinolenta of Rudolphi. They were found also in connection with the walls of the stomach and œsophagus, as had been stated by Czernay and others; in the walls of the blood-vessels, especially of the thoracic aorta, in the interior of fibrous tumours of from the size of a pea to that of a filbert, or even of a walnut. On the walls and in the substance of the coats of the vessel there might be seen a pitted or sacculated or atheromatous condition of the inner coat. There was also an enlargement and softening of glandular structures near the base of the heart.

The tumours of the aorta afforded opportunity of studying the growth of the parasite from an early period up to maturity, as specimens of almost every stage of development were found lodged in the walls of a single aorta. The parasite lies coiled up in the tumour; they are immature, $\frac{1}{10}$th of an inch in length, $\frac{1}{150}$th in breadth, some smaller. When at this stage they moult; further changes take place, and by the time the worm has become three-quarters of an inch long, reproductive organs can be made out. It now gradually acquires a pinkish colour, and instead of occupying a small tumour alone, it joins other worms in a larger tumour, each occupying a different tunnel. Some make their way outside. When mature, the worm is from three-quarters of an inch to one inch long, and one-fortieth of an inch broad. The female is two to three inches in length. They were also found in the thoracic glands and stomach. The *ova* are oval, $\frac{1}{200}$ of an inch in size. When crushed, an *inactive* embryo escaped. Lewis has doubts as to the habitat of these embryos, whether it be the moist earth, the water, or the intestinal tube of some other creature; but we have thus the opportunity of watching the development of the *sexually mature* worm. Manson made similar investigations on Chinese dogs, and found Filaria sanguinolenta associated with Filaria immitis. The free embryos in the blood of such dogs are probably the progeny of either or both—Filaria immitis and Filaria sanguinolenta. It is said that Filaria sanguinolenta is oviparous, whilst Filaria immitis

is viviparous. Filaria immitis is larger than Filaria sanguinolenta. It is found in the mature form *in the heart* of the dog, and its broods of embryos swarm in their blood.

Dr. Manson describes the following diseased conditions in dogs caused by filariæ :—Filaria sanguinolenta gives rise to three serious morbid states—(1) stricture of œsophagus; (2) pleurisy; (3) paralysis of hind legs—caused by the presence of the worm in the tissues about the œsophagus, forming tumours—tumours bursting into the pleura—plugging of the capillaries of spinal cord by ova, etc.; and other affections that may be produced by them in the intestines, kidneys, or other viscera. The Filaria immitis, on the other hand, affects the heart and lungs. By arrest in the lungs they give rise to tuberculoid tissue, at all events an infiltration resembling miliary tuberculosis; but more frequently they manifest themselves in the heart's action by interfering with the integrity of the valves, or the capacity of the pulmonary artery or its branches. Death not unfrequently results suddenly; or there is a gradual failing of circulation and respiration, ending in death. Such animals are short-winded, and liable to attacks of syncope. And one can readily imagine many other complications arising in one so affected; and it is said that two-thirds of them are so in China, where they frequently are the subject of *both* filariæ.

Their mere *presence*, even in great numbers, does not necessarily produce symptoms of disease; and this is very remarkable when we consider the demand these creatures may make on, and the changes they may effect in, the nutritive fluids. It is interesting to notice the action of other allied forms in man—*e.g.*, Trichina and Dracunculus behave nearly in the fashion of Filaria sanguinolenta in the dog: they migrate, pierce the tissues, develope, burst, and give exit to embryos, which set up irritation, and perhaps induce pain and other secondary affections; and yet there is a period in their existence too, during which there is little, if anything, to indicate their presence. Recently, we have learned from the French physicians Drs. Normand and Bavay, of minute nematodes from Cochin China—the Anguillula stercoralis,

and A. intestinalis. The former, found in the stomach, the whole length of the intestine, pancreatic and gall ducts, is 1 millimetre in length, and 0·04 broad; the latter, in the hepatic duct, walls of gall-bladder, but less frequently than the former, is three times its length, and sixty-five times its breadth. These are described as giving rise to dysenteric diarrhœa, which is very intractable and apt to end in marasmus. A description of this parasite may be found in the *Archives de Medicine Navale* for September, 1878.

We have still much to learn about these human nematodes as regards their mode of entry into the body, their locality, habitat, and the mode in which they become sexually mature, where and when fecundated, at what period the embryos are let loose among the tissues, how they find their way into the blood- and lymph-vessels, and the precise relation that these vessels bear to each other as carriers of the ova or embryos. The subject is in the hands of competent observers, and we may look with confidence for a solution of what now seems obscure, especially in India, where post-mortem examinations apparently are more easily obtained than in China.

I have given a brief outline of the principal facts relating to the human-blood filaria; and have alluded to some of those connected with its congeners that affect the lower animals, so far, at least, as they throw light on what is obscure in the human parasite. It remains to be shown in what direction we are to look for further information. I have said that Filaria is frequently associated with, if not the actual cause of, chyluria and other disturbances of the lymphatic system; it is on this part of the economy, indeed, that its influence is specially exerted. Some years ago, in writing about Nævoid Elephantiasis, I said I thought it probable that other forms of disease would prove to be due to Filaria. I repeated the observation in 1876, when writing on Sonsino's discovery of the Filaria in Egypt; and now evidence is accumulating that in it is to be found the explanation of much that has hitherto been etiologically uncertain. I believe that we are still only on the

threshold of discovery in regard to this form of helminthiasis.

Dr. Bancroft suggests that the following conditions are probably associated with Filaria:—Chyluria, hæmaturia, anæmia, tuberculosis, hydrocele with milky fluid, varicocele, elastic tumours in axilla and groin (Helminthiasis elastica), lymph-vesicles bursting in scrotum and abdomen, skin disease (Craw-craw), acute orchitis, lymphangitis with fever, erysipelatous lymphangitis leading to hypertrophy of skin (elephantoid fever, in short), elephantiasis of scrotum and leg, contraction of lymphatic trunks with neuralgic pains, abscess of scrotum, of glands of neck (like struma), of the lymphatics of the arm and thigh, intra-pelvic abscess, peculiar steatoma of face, venous varix, cerebral abscess, and other lesions of brain—a long list, suggestive of interference with the free passage of the nutritive fluids.

Manson's experience in China, and that of Lewis, McLeod, McConnell, Ewart, Carter, Palmer, and others, in India, shows that elephantiasis, nævoid and simple, is associated with filaria; probably to these may be added other affections of the lymph system. My impression is that other morbid conditions—tropical cachexiæ, paraplegia, and other nervous disorders; inflammation of serous and gastro-intestinal mucous membranes; diarrhœa, and certain forms of dysentery—may be due to it, directly or indirectly. Beri-beri, anasarca, dropsy, albuminuria, hæmaturia, may, like chyluria, receive a new explanation. The vague chronic ailments that sometimes adhere to old residents of tropical or sub-tropical climates may, in some instances, depend on the past or actual presence of these hæmatozoa. There are certain forms of hydrocele, epididymitis, and inflammatory conditions of the spermatic cord and its appendages, peculiar to tropical climates, that long puzzled me as to their etiology, which now begin to appear more easily accounted for—the tendency of the blood to form fibrinous coagula while within the walls of the living vessels and heart; the embolism, thrombosis, cardiac and pulmonary arterial pluggings; the arterial, venous, and capillary obstructions resulting in death;

apnœa, gangrene, softenings, ulceration. That peculiar tendency in the blood of persons in malarious climates, notably Bengal, to form those fibrinous clots in the heart and pulmonary artery, so often fatal, may, in some measure, be referred to the same cause,—not always surely, but possibly in some cases? I merely suggest it as worthy of consideration. The dogs in China die suddenly from interference with the heart's action due to filaria—whether to direct mechanical interference, or to altered conditions of the blood, I cannot say; but that which occurs in the dog may, from a similar cause, happen in man. At all events, I know from experience, that men do so die and suffer in Bengal. Whether they are filarious or not remains to be shown. Had I known of filaria when I had such cases I should certainly have looked for it; and may it not be possible that such conditions as result from obstructed capillaries—boils, anthrax, local death of tissue, abscesses, ulcers—whether of skin or other tissue, the viscera themselves, are sometimes so caused? The blood-vessels may suffer from aneurism, varix, or other condition of disease. In the dog they are so affected. So with stricture of the œsophagus, may we not, I repeat, in the present imperfect state of our knowledge, look for similar diseased conditions in man? Analogy warrants it, I think. Manson says that in the blood of 670 persons examined, of whom 195 were in apparently good health, he discovered filariæ fifty-three times associated with some morbid state, and nine times coexistent with the appearance of perfect health. Here is the list of what he found:—

	No. of cases.
Elephantiasis of scrotum	3
,, of leg	1
Lymph-scrotum and chyluria	2
,, ,, elephantiasis	1
,, ,, inguinal varix	1
Lymphatic inguinal varix	1
,, ,, ,, { co-existent with ulcer of cornea }	2
Hæmatemesis	1
Cataract	1
Ulcer of leg	4

	No. of Cases.
Hydrocele	3
,, and rheumatism	1
,, and cataract	1
Rheumatism	1
Tumefaction of spleen	1
Fever and anasarca	1
Leprosy	2
Debility	1
Intermittent fever	2
,, ,, with enlarged spleen	1
,, ,, with inflamed scrotum	1
Hydrocele and fever	1
Chronic eczema	1
Internal hæmorrhoids	1
Stricture of œsophagus	1
Heart disease and ulcer	1
Total	37
Free from apparent disease	9
	46

It would seem that many forms of disease may be associated with, if not caused by, the parasite in one or other of its genetic phases. But it is necessary to be careful lest, in enthusiasm about a new discovery, too universal application be made of, and more ascribed to it, than is its due.

Important questions arise out of the preceding considerations. 1. Whence does Filaria come? 2. What can we do to prevent or remove it?

The second question will be best answered when we are able to reply satisfactorily to the first. When we know the origin and are assured of all the genetic phases, the whole life-history—we shall be in a better position to deal with it. Prevention is the first desideratum, but when infection has occurred we need some effective parasiticide; and it is not improbable that such may exist—carbolic acid, sulphurous acid, arsenic—or it may be that some of the remedies which have proved useful as antiperiodics or febrifuges have owed some part of their virtue to anti-hæmatozoal properties. Secondary consequences, such as those described in Dr. Manson's list, are to be treated on ordinary medical and surgical principles.

The area of distribution of these diseases is said to correspond with the geographical distribution of Culex. Where the mosquito is rare the diseases attributed to Filaria are said to be infrequent. Manson advocates this view and the importance of the part played by the mosquito as intermediary host and propagator of the parasite. He certainly has grounds both in fact and analogy for his belief. Dracunculus employs the microscopic crustacean Cyclops as an intermediary host; its second stage is thus, like that of Filaria, passed in another creature. They both find their way, through the medium of water, back to man. He adduces an authenticated instance of importation of the disease of elephantiasis by a single individual into Barbadoes. The mosquitos sucked his blood, and with it embryo filariæ; they were thus disseminated, and the disease has been ever since endemic in the island, where it was before unknown. One could hardly prove that the dissemination actually took place by means of the mosquito, but the appearance in the island of elephantiasis soon after the advent of a particular individual is authenticated. In any case, whatever part the mosquito may play, the water must be regarded with grave suspicion, and the greatest care observed in securing its purity; whilst, in view of what we suspect of the mosquito, it is desirable that that insect should be kept from access to all water supplies whether for drinking or bathing, and that the water should be boiled before using. Sanitary science has already reduced the death-rate of our soldiers in India from 60 to 16 per 1,000. It may here achieve further triumphs! It will do well, at all events, not only to insist on pure water, but to keep an eye on mosquitos, and other possible intermediary hosts. The best way of getting rid of an entozoal pest is to break its genetic cycle.

In conclusion, I would say the discoveries of the Filaria and its relation to disease are so complete, as far as they have gone, that it seems hardly right to trespass on ground so originally and advantageously occupied. I have but imperfectly represented the work already done, and having

had considerable experience of the diseases ascribed to Filaria, I feel so far qualified to express my sense of the value of the light that has been thrown on a very obscure subject. The subject is still in its infancy, and further research may modify much we now seem to know; but it is a new and original track, and if I mistake not, one that will lead to important results—new explanations of the cause of disease, new methods of prevention and treatment, it may be—that will be beneficial to mankind.

SUNSTROKE AND SOME OF ITS SEQUELÆ.

From "Brain."

UNDER the designations of sunstroke, coup-de-soleil, heat-apoplexy, heat-asphyxia, thermic fever, ardent fever, insolation, calenture, and others, are included certain pathological states, which, though differing from each other materially, are not unfrequently confounded.

1st. There is simple syncope from exhaustion caused by heat.

2nd. A condition analagous to shock, due to the action of the direct rays of a powerful sun on the brain and cord; the nerve-centres, especially the respiratory, are affected; respiration and circulation rapidly fail, and death may result; recovery is frequent, though not always perfect.

3rd. Over-heating of the whole body, blood, and nerve-centres, either from direct exposure to the sun's rays, or more frequently, to a high temperature out of them, causing vaso-motor paralysis and intense pyrexia; respiration and circulation fail, and asphyxia follows. Recovery frequently occurs, but is often incomplete, owing to structural changes in the centres, giving origin to a variety of symptoms indicative of lesions of a grave character, some of which are well illustrated in the cases subsequently cited.

The cases of simple exhaustion and syncope may occur during great fatigue or over-exertion, or when there is depression of vital power from any cause during exposure to a high temperature, as in the case of the stokers and engine-

room men of steamers in the Red Sea or the tropics, when the temperature rises to 120° and upwards, in the vicinity of the furnaces where they are employed; or in the case of men, especially Europeans, in the tropics who are exposed to the intense heat and light of the sun's rays, which taking effect on the head, neck, and body, produce a condition like shock acting through the vagus and vaso-motor system. There is depression of nerve force and of muscular power; the skin is pale, cold, and moist, the pulse feeble. Death may occur in this state from failure of the heart, but complete recovery more frequently occurs. Asphyxia and apnœa may come on after premonitory symptoms of depression and weakness, during exposure of the head and spine to the direct rays of a powerful sun, when the atmosphere is much heated, and the nervous energy is depressed by over-fatigue, illness, or dissipation. The brain and respiratory nerve-centres are overwhelmed by the sudden rise of their temperature, respiration and circulation fail, the latter probably owing to inhibitory action of the vagus. When death takes place very suddenly during great excitement or exertion and exposure to heat, it has been ascribed to rapid coagulation of cardiac myosin.

This, however, though it *may* occur occasionally, is generally a post-mortem change, the heart's action being really brought to a close by heat, in the same manner as it has been shown by Claude Bernard and Lauder Brunton, that the effect of a very high temperature on animals is first to accelerate, and finally to stop the heart, and especially the ventricles, in a state of tetanic contraction.

Recovery, though frequently complete, is sometimes tedious, and occasionally imperfect, ending in serious impairment of health or intellect.

The symptoms of this form of sunstroke are those of sudden and violent lesion of the nerve-centres; unconsciousness, cold skin, feeble pulse, and all the signs of depression, terminating in death by shock; or fatal reaction may result, with a variety of conditions pointing to injury to the cerebro-spinal system. In another class of cases, there is ardent fever, the body

generally, including the nerve-centres, is heated intensely; this may occur quite independently of the direct action of the sun's rays. It comes on frequently at night, or in the shade, in a building or tent, especially in persons who are depressed by fatigue, bad air, over-feeding, alcoholic stimulants and the consequent depression, want of rest, illness, and notably when the air is impure from over-crowding, or from insufficiency of cubic space.

The temperature of the body may rise to 108°—110°; respiration and circulation fail; there is dyspnœa, hurried gasping respiration, great restlessness; pungently hot skin, sometimes dry, occasionally moist. The pulse varies; in some it is full and labouring, in others quick and jerking; the head, face, and neck are livid and congested; the carotid pulsation very perceptible; pupils, at first contracted, dilate widely before death. Coma, stertor, delirium, convulsions, frequently epileptiform in character, with relaxation of sphincters, and suppression of urine, are the precursors of death by asphyxia, and it may be that there is cerebral hæmorrhage.

Such are the cases to which the term heat-apoplexy is given; and a large proportion of the fatal cases among Europeans in India is so caused. Recovery may partially occur, to be followed by relapse and death; or secondary consequences, the result of tissue-change, may destroy life or impair health and intellect at a later period. The premonitory symptoms of this form of the disease may appear some hours or even days before the dangerous condition just described supervenes. There may be general malaise, disordered secretions, profuse and frequent micturition, restlessness, insomnia, apprehension of impending evil, hurried and shallow breathing, precordial anxiety, gasping, giddiness, headache, occasionally nausea or vomiting, thirst, anorexia, feverishness, which soon amounts to fervent heat of skin; the surface may be dry or moist, the pulse varies; these conditions gradually become aggravated and frequently are worse at night, when the patient passes into a state of unconsciousness and dies.

The symptoms point to a profoundly disturbed state

of the cerebro-spinal nerve-centres, and to pathological changes in the organs whose functions have been so greatly disturbed.

Death is caused by asphyxia and apnœa, in some cases probably by cerebral hæmorrhage. Recovery is often incomplete, there is permanent impairment of health, and generally intolerance of heat and of exposure to the sun. These morbid conditions being due to heat alone, are liable to occur whenever there is exposure to a high temperature, whether solar or artificial. Soldiers marching or fighting, when oppressed by weight of clothing or accoutrements, are apt to suffer either from simple heat-exhaustion or from that form of insolation which results from direct action of a powerful sun on the head and spine. This is common enough in India and elsewhere during the hot season. It is not unknown in Europe, even in England during the dog-days. Soldiers, labourers, artificers, and people in factories, heated rooms, hospitals, barracks, tents, and even ships, may suffer from heat-exhaustion, which may pass into the same dangerous condition of heat-asphyxia. People in the hay-field, or otherwise exposed to great heat in this country, especially if they have indulged in excess of alcoholic stimulants and food, may suffer.

Men serving in the engine-room of steamers in the tropics —the Red Sea for instance—are often brought on deck in a state of complete exhaustion, from which they generally recover under the reviving influence of the cooler air, a douche of cold water, or a stimulant; weak persons with defective hearts may die in this state of syncope. Soldiers, or others, when exposed to great heat, may drop out of the ranks, fall in a state of syncope, and die on the spot, or pass into a state of coma and die later; or they may recover, after being in great danger, with damaged nerve-centres, and are rendered quite unfit for further service, or even residence in a hot climate. These cases occur on exposure to the direct action of the sun's rays when the atmospheric temperature is also high, and especially when unusual exertion is made, or when the individual is depressed by previous illness or the

exhaustion due to dissipation, intemperance, and undue indulgence in stimulants.

But the most serious cases are those that come on under cover by night as well as by day, and apart from the direct solar rays. A form of disease described in India as ardent fever is of this character, supervening on the ordinary phenomenon of ephemeral fever. Heat alone, especially when the atmosphere is loaded with moisture so as to prevent evaporation from the person, is the real cause of the disease. Malarious and hygrometric conditions have no special influence beyond that which they may exert on the general vigour of the constitution, thus predisposing the person to suffer.

The dry atmosphere of Upper India, with its hot winds, is much better tolerated than the damp atmosphere of Lower Bengal or Southern India, though the temperature is lower. Hot dry air favours evaporation, and thus keeps the body cool, whilst in the damp air, as evaporation lessens, the natural cooling power is greatly diminished.

Vigorous, healthy persons of moderately spare frame, with sound viscera, and who are of temperate habits, can sustain a great amount of heat if the atmosphere be pure and moderately dry. Acclimatization has also some influence in conferring toleration. Fresh arrivals in the tropics are more prone to suffer than those who have become accustomed to the climate and have learned how to protect themselves. It is well known that a native can bear an amount of sun on his bare head and naked body with indifference, almost pleasure, that would rapidly prostrate a European. But when the temperature rises above a certain standard all succumb, and natives of India suffer and die like others, in numbers, every year from "loo marna"—hot-wind stroke.

The extent and duration of the toleration of heat depend much on the vigour of constitution and actual state of health. The refrigerating powers of the body, when in health, enable it to support a very high temperature, considerably above that of the blood. Thus in the hot winds

little inconvenience is felt so long as perspiration is free, but when that fails, suffering soon ensues, and the danger is great.

In the Sixteenth Annual Report of the Sanitary Commissioner with the Government of India, 1879, it is stated that 339 cases of heat-apoplexy and sunstroke occurred in the army in India, of which 128 were fatal. The admission rate was 5·7, the death rate 2·17 per 1,000. There is nothing calling for special remark in the ratios of the different Presidencies as compared with their former history. Of the 339 cases, 266 occurred during the four months of May to August. The disease was widely spread. In proportion to strength there is no remarkable number of attacks at any one place, except at Meean-Meer, where, in a strength of 889 men, there were 13 cases in July; Nowshera, strength 630, gave 23 in June and July; Peshawur Valley, force 3,431, 28 cases in May; Malliapoorum, in Madras, gave 13 cases among 93 men in May. (Table xxxii., Sany. Coms. Govt. of India, 1879). It is said to give rise to a fatality of 12·2 per cent. in the first and second years of the European soldier's service in India.

The deaths per 1,000 strength were:—

Service.		
1 to 4 years.	5 to 7 years.	Above 7 years.
1·48	1·05	1·50
Age.		
Under 25.	25 to 29.	30 and upwards.
·65	·99	2·33

But of those who recover, or rather who do not die, many are permanently injured and remain invalids for the rest of life, which is frequently shortened by the changes induced. The cases hereafter cited, for which I am indebted to

Dr. Christie, the able superintendent of the Royal Indian Asylum at Ealing, will show what sad effects sunstroke may have on Europeans in India. These may be due to obscure cerebral or meningeal changes, which affect the sufferer in various degrees of intensity. Irritability, impaired memory, epilepsy or epileptiform attacks, headache, mania, partial or complete paraplegia, partial or complete blindness, extreme intolerance of heat, especially of the sun's rays, rendering a person otherwise fairly healthy quite incapable of serving in hot climates or of enduring any exposure to the sun; or, it may be, complete fatuity, dementia, chronic meningitis, with thickening of calvaria, causing intense cephalalgia; or in disordered innervation and general functional derangement, and impaired health.

In cases where death has occurred suddenly, from syncope or shock, there is no very remarkable morbid change. The heart may be firmly contracted—it has been found in animals that have died from exposure to a high temperature, when the blood was heated to 110°—112°, that the heart was tetanically contracted—but not invariably, for it was often flaccid. The lungs, brain, and its membranes may be congested, but sometimes they are quite the reverse. As occurs in shock, the venous trunks, especially those of the abdomen, and the right side of the heart itself, may be filled with dark, grumous, imperfectly coagulated blood, which is also effused in patches of ecchymosis, causing the body rapidly to become livid. The coagulability of the blood is impaired, and it is deficient in oxygen.

In death from ordinary cases of thermic fever (insolation), the lungs and pulmonary system are often deeply congested; and the heart is firmly contracted with coagulation of myosin, whilst the whole venous system is engorged. The body, even before death, may be marked by petechial patches and extensive livid ecchymosis. The blood is generally fluid, grumous, and it may be acid in reaction. The globules generally present no abnormal change, but are sometimes crenated and have a diminished tendency to form into rouleaux. The body for some time after death

retains a high temperature; the viscera and interior feel pungently hot. Rigor mortis comes on very rapidly. The brain and membranes may be congested; in some cases there are evidences of cerebral hæmorrhage and serous effusions in the ventricles.

Treatment.—In cases of simple exhaustion, remove the person to a cooler place, if possible. Apply a douche, but not too prolonged. Rouse, and gently stimulate; remove tight and oppressive clothing; apply ammonia to nostrils, etc. Enjoin rest, and prevent exposure to over-fatigue or great heat.

In the form of sunstroke, where the person is struck down suddenly by a hot sun, remove him into the shade, and let a douche of cold water fall freely on the head and body, from a pump, from a mussuck (in India), or other similar contrivance; the object is twofold—to reduce the temperature, and to excite reflex action. During the assault on the "White House picket," at the capture of Rangoon in 1853, many men were struck down by the fierce April sun. They were laid out in rows, perfectly unconscious, *in their red coats and black leather stocks* (they wore them, in those days, even in action under a tropical sun), and so treated. Nearly all recovered—for the time, at all events—under the influence of the douche, freely applied over the head and body. In some cases, flagellation with a sweeper's broom was effective, especially in one case, that of a Brigadier-General who appeared to be moribund. All recovered, except two, who had been bled before I saw them.

In addition to the douche, mustard-plasters to various parts of the body, legs, abdomen, etc., and stimulating enemata to relieve the loaded bowels and rouse the patient, may be useful.

When I say such cases recovered, I refer to the reaction at the time, for in some there were consecutive symptoms of fever, cephalalgia, etc.; and, were we able to trace their subsequent history, we should probably find that complete recovery never occurred. If signs of lesion of the nerve-

centres, or meningitis appear, treatment of a more active character will be needed.

Exposure to the sun must be carefully guarded against in future, and, unless recovery has been rapid and complete, the sufferer should be removed to a cooler climate, and protected from excitement of mind or body, whilst the greatest care is taken to avoid all errors or excesses of diet and stimulants.

In the graver cases of thermic fever, or heat-asphyxia, heat being the primary cause of the disease, the object is to reduce temperature as speedily as possible, and before tissue-changes have taken place. As the hyperpyrexia is due not only to the direct operation of heat on the nerve-centres, blood, and tissues, but to the fever set up by vaso-motor disturbance, remedies that may influence this condition are indicated. Hypodermic injections of quinine and of morphia have been considered to produce good results by reducing temperature and blood-pressure. Quinine, I think, may do this; the morphia is questionable.

Bleeding has now been abandoned except in rare and peculiar cases. The congested livid surface, coma, and stertor which formerly suggested it, do so no longer. There are cases in which it may be necessary in order to avert suffocation, but they are, I think, exceptional. Bleeding may have appeared at first to give relief and mitigate the symptoms, but the improvement has been transient, and followed by relapse into a more dangerous condition.

No absolute rule in this or any disease can be laid down in regard to abstraction of blood. It is possible that there may be more danger to life from a labouring and distended heart and embarrassed lungs, than from the loss of a few ounces of blood, which, if it tided the patient over that danger, as I believe it sometimes might do, would be the lesser evil. Each case must be treated on its own merits.

The treatment generally, consists in judicious application of cold by affusion, or by ice, taking care not to reduce the temperature too low. A thermometer in the axilla, mouth, or rectum, will be the guide.

Great care should be taken not to prolong the cold application too far, as danger would result from continued depression of the temperature below the normal standard of blood-heat. The bowels should be relieved, and blisters may be applied to the scalp and neck, though I cannot say I have much faith in their efficacy. In the epileptiform convulsions which so frequently occur, the inhalation of chloroform may be useful, but its administration must be carefully watched. The most severe symptoms having subsided, the fever that follows must be treated on ordinary principles, and the diet carefully regulated. As improvement progresses, if symptoms of intra-cranial mischief begin to supervene, such as meningitis; iodide of potash and counter-irritation may be of service; and removal to a cooler climate is essential. As a general rule it is desirable that the sufferer should not, for a long period at least, return to a hot climate, and he should be guarded against exposure to heat, overwork, and anxiety of any kind.

The sequelæ of sunstroke are often very distressing, and render the patient a source of anxiety and suffering to himself and to his friends.

The less severe symptoms—those of the slighter forms of meningitis, or of cerebral change—occasionally pass away after protracted residence in a cold climate, but not unfrequently are the cause of suffering, danger, and shortening of life, owing to chronic lesions of the cerebro-spinal centres.

The following cases, for which I am indebted to Dr. Christie, illustrate the evil effects that, more frequently than is perhaps imagined, result from sunstroke.

"I send you, as far as I can learn them, short histories of some cases of insanity following sunstroke. I believe the whole of them are uncomplicated with insobriety. As a rule, the previous histories are not very replete with information, and only in one or two cases have I therefore been able to go very fully into them.

"It appears that the attack in most cases was the same, and

of a violent character; the onset was of an inflammatory type from the symptoms displayed, gradually settling down into imbecility; the few post-mortems gave confirmatory proof of this in the adherent and thickened membranes.

"The second case was interesting, as showing the violence of symptoms during the whole attack, and which appeared to arise from the pressure of the plates of the skull, not, however, altogether the result of the sunstroke, as there is evidence of injury when young; here a resemblance is observed in the case of Surgeon-Major M., in whose case the bony growths were hereditary, and the same violence of symptoms was exhibited. In no case was recovery complete; although improved, a certain amount of imbecility resulted.

"Looking at the result of the post-mortem, I am led to think that the worst of insanity after sunstroke is of an acute inflammatory character, attacking the membranes of the brain, and thus the grey substance, so that we find the mental symptoms more clearly defined than the physical; only in the one case of Surgeon-Major J. M. were the physical characters clearly marked, and in this case paralysis was permanent from the first onset of disease.

"How far an alteration of structure of bony growth may be traced to coup-de-soleil is a matter for further consideration; in all the cases I have had under care, the diploë has been found obstructed, and the skull plates thickened, dense, and heavy, with, in two cases, distinct growth of bone; but both these cases are involved in their etiology, in the one case by an early injury, and in the other by a most decided hereditary taint.

"At the present time I have two cases under treatment, the one a case of acute mania, with partial recovery, following coup-de-soleil in Bengal; the other a case that occurred last summer here in the country, not followed by actual mania, but an inability to use the brain as formerly, coupled with grave symptoms at the present time, such as headache, squinting, and incapability of fixing attention, coupled with sleeplessness. Of both of these cases I hope to get a complete history."

Case 1.

"Gunner J. M., aged seventy-one years. Went to India in the year 1839, and was a steady, well-conducted soldier. On April 13th, 1843, was admitted into hospital for coup-de-soleil, and was discharged as recovered May 29th following. He was readmitted on June 18th, complaining of pains in the head and abdomen, but was discharged in three days. July 12th he was again admitted, having been drinking, and became very excited, but was discharged on August 12th. This went on till, the excitement increasing, he was admitted into the asylum, January 23rd, 1844, for hypochondriasis, but soon after showing symptoms of imbecility, he was sent home to England. On board ship he became violent, on several occasions attacking those about him, and threatening to throw them overboard. He arrived in England, September, 1844, and was admitted into the Asylum at Hackney. Here his case ran through the usual course, resulting in dementia, with general incoherence of language, and silliness of manner. He is a Roman Catholic, and many of his delusions relate to the fasts of the church, fancying, *e.g.*, that Saturday is a fast-day, and will not eat meat. He is still living, with symptoms of cerebral atrophy."

Case 2.

"Ensign P. F. T., aged fifty-one years at death. This gentleman, when about three years of age, fell from a table, and received a severe blow on the back of the head; very soon after, he appeared drowsy and was sick, and in the course of a few days symptoms of acute inflammation of the brain came on, and he became perfectly unconscious. The attack soon subsided under active treatment, and he recovered. At the age of seventeen he went to India, and within two years was attacked twice with fever, and appa-

rently slight inflammation of the brain; subsequently, when exposed, he was struck down with coup-de-soleil, from which in a few days he apparently recovered. After this his correspondence was noticed to be irregular, and the style of his letters incoherent and rambling. His conduct partook of the same character, until decided insanity necessitated his return to England. He recovered considerably on the voyage, and resided with his friends for a few years, during which they noticed a gradual increase of symptoms, till his violence was so great that he was sent to the Asylum at Hackney, where he was admitted July 18th, 1845, suffering from acute mania. His symptoms continued, and he became noisy, violent, fretful, and took a great dislike to his mother and other relatives. In August, 1870, he was transferred to Ealing, and continued to show the same symptoms. On July 5th, 1871, he complained of great pain in the hepatic region, and he was ordered a purgative; this did not, however, remove the pain, and in two or three days violent diarrhœa came on, which was not checked by chlorodyne, opium, etc.; on the 14th his temperature was 98·4°, and pulse 100; there was no tenderness, and the skin was acting freely. July 16th, temperature 99·4°, but the pulse fell to 98, the diarrhœa continuing with blood; this went on till the 24th, when he died.

"Post-mortem revealed an enormously enlarged liver, adherent to the diaphragm: on attempting to separate it, an abscess of the size of a cricket-ball burst, in addition to which the right lobe was found to contain six separate and distinct cavities. Intestines congested, villi distinct, with ulceration of the glands, especially in the colon. Kidneys pale, but healthy. Spleen small. Right lung adherent, and a small abscess over the liver in the lower lobe, partially hepatized, and corresponding to the liver. Heart healthy.

"Calvaria dense and heavy; over right parietal bone an apparent bulging, and over the middle suture thickened—the result of early injury. Membranes thickened, arachnoid opaque, with patches of lymph, the result of old inflammation. Convolutions flattened, grey substance pale and very

defined, brain generally firm but anæmic. Brain small and atrophied. Base of skull rough, with prominences of bony deposit, some being very sharp."

Case 3.

"Gunner A. F., aged twenty-six years. Admitted into Colaba Asylum, Bombay, February 22nd, 1845, after about two years' treatment in hospital for coup-de-soleil. During that time he complained of headache, ringing in the ears, loss of sleep, and delirium; this went on till September, 1844, when he became violent, and shouting continually. On admission he was suffering from low fever and diarrhœa. Imagined people were talking and speaking to him, and that they were trying to force air into his bowels. The usual treatment was pursued, and he was sent home, arriving in England in May, 1864. He improved considerably on the voyage, but still had delusions; these, however, soon disappeared, and he was handed over to the care of his friends in the following month of June. Nothing more has been heard of him."

Case 4.

"Gunner R. M., aged thirty-one years. As far as can be learned, a sober steady soldier. Was admitted into Regimental Hospital, July 25th, 1849, suffering from the usual symptoms of coup-de-soleil; from these he recovered and left, but was brought back in a few days, being found wandering about and talking incoherently; he gave sensible answers to questions, and there did not appear to be any suspicions as to drink. This went on, leaving the hospital for a short time, and being readmitted again, till he was sent to the Asylum at Fort William, and admitted there, March 19th, 1851. He was treated with cold baths, purgatives, etc., and not improving was sent home to England and admitted to the Asylum at Hackney, April 30th, 1852,

having sunk into a state of dementia, with general incoherence; he continued thus till he died from phthisis, on June 4th, 1856. Post-mortem revealed the calvarium very adherent to the membranes, the plates of the skull of unusual thickness, being at least a quarter of an inch, with the diploë filled up; the arachnoid contained about two ounces of serous fluid; pia mater opaque and thick. The substance of the brain was firm, but appeared healthy. The brain was small. Lungs studded with tuberculous matter."

Case 5.

"Private J. F., aged twenty-two years. Believed to be a sober man. Was attacked with sunstroke, April 12th, 1852, and taken to hospital; he improved slightly under treatment, but gradually became much excited and subject to various delusions, imagining people were trying to kill him. On April 30th, 1853, he was admitted to the Lunatic Asylum, Madras, and after a short time sent home to England, arriving September 14th, 1853, and admitted into the Asylum at Hackney; he was in a state of dementia and in weak bodily health. In the following January, viz., the 7th, he died from chronic dysentery. The result of post-mortem examination was as follows:—Calvaria dense; brain substance firm, and apparently healthy; membranes adherent, with about five ounces of serum within the arachnoid."

Case 6.

"Private J. T., aged thirty years. This man had an attack of coup-de-soleil in Bengal, in August, 1857, after which his mind was disordered, and he appeared to be suffering from general paresis. On July 13th, 1858, he was admitted into hospital, and found in a state of amentia; was transferred on July 21st, 1859, to the Lunatic Asylum, Madras, and sent home to England, arriving April 10th,

1859, suffering from general paresis. The disease ran the usual course, and he died July 17th, 1860, but no post-mortem appears to have been made."

Case 7.

"Private J. F., aged thirty years. A sober, steady man, had sunstroke at Moulmein in October, 1857, and was sent to hospital, where he was under treatment till August, 1858, and appeared to recover so as to be sent to duty. On January 9th, 1859, he was again sent to hospital for irritability and strangeness of manner, refusing to do his duty, etc., and was then thought to be insane, though he did not appear to have any prominent delusions. Not improving, he was, on March 2nd, 1860, sent to the Lunatic Asylum at Madras, and forwarded home to England, arriving on June 28th, 1860, and admitted into the Asylum at Hackney. He was suffering from chronic mania, and did not improve, dying on April 8th, 1861, from disease of the liver. Post-mortem examination:—The calvaria was thick, dense, and heavy, the diploë being obliterated. Dura mater thick, with opacity of the pia mater. The brain substance appeared firm, the grey matter varying from a quarter to half an inch in depth. The ventricles contained a small amount of fluid, and a large number of cysts were on the choroid plexus; the convolutions seemed natural."

Case 8.

"Gunner P. F., aged twenty-nine years. Appears to have had sunstroke in 1859, and was admitted into hospital, November 12th, suffering from cephalalgia. Complained of pain, principally at the occiput; he was strange in his manner, as evinced by his dress, putting his belts on wrong, etc.; he improved for a few days, and then gradually became worse; but was kept under treatment till he was admitted into the Lunatic Asylum, Colaba, Bombay, on August 26th,

1860. He did not improve, and was sent home to England, arriving April 25th, 1861, and admitted into the Asylum at Hackney. He remained very silly, and on September 16th, 1865, he was sent to his friends in Ireland, and nothing more has been heard of him."

Case 9.

"Seaman T. T., aged twenty-two years. Had sunstroke on the voyage out to India, and on arrival there was found to be insane, so was sent home to England, arriving August 8th, 1863, and was admitted to the Asylum at Hackney, suffering from mania. He gradually improved, and on February 16th, 1864, was sent home to his friends, and nothing more has been heard of him."

Case 10.

"Private J. M., aged twenty-seven years. Of sober habits and healthy constitution. Admitted into Depôt Hospital at Benares suffering from acute symptoms, the result of coup-de-soleil. His brain was very active, and he suffered from violent delirium, requiring force to keep him quiet. After a few days this passed off, leaving him very low. His memory seemed affected, and although not violent, he was unmanageable and subject to occasional paroxysms of violence. There is no history of hereditary taint. Treated with cold affusions and tonics.

"Admitted into Fort William, Bhowanipore, December 30th, 1858, suffering from sleeplessness, subject to despondency and paroxysms of violence. Treated by tonics. Sent home to England, and on ship's arrival in September, 1859, was so far recovered as to be allowed to go to his friends."

Case 11.

"Pensioner J. D., aged forty years. Admitted into General Hospital, September, 1863, with the loss of the use

of his right side after coup-de-soleil. From this he recovered and was discharged. After this he had a loss, and it appeared to prey on his mind, so that he was admitted into Bhowanipore Lunatic Asylum, November 28th, 1863. Was violent and noisy, striking his head against the wall, attempting suicide; but after a short time he became quiet, and was sent to England, arriving April 26th, 1864, and admitted into the Asylum at Hackney, suffering from dementia and general paresis. The disease ran the usual course, and he died April 29th, 1867, but no post-mortem was held."

Case 12.

"Lieut. R. M., aged twenty-six. Had sunstroke at Arrah, but no particulars were sent with him. He was of temperate habits, and was admitted into Bhowanipore Lunatic Asylum, December 9th, 1864, labouring under various delusions of a personal character. Was noisy and violent, imagining his relatives ought to be shot for cowardice. He was sent home, arriving in England, January 28th, 1865, and admitted into the Asylum at Hackney. He remained much the same, and was removed by his friends, January 29th, 1866."

Case 13.

"R. L., aged twenty-two years. Was out in the sun, shooting one morning; after exposure to solar influence, he returned home and soon after became insensible, with stertorous breathing and convulsions. No medical man saw him, and he was sent to Kyouk Phyoo in Aracan, Burmah, for treatment. He gradually became conscious, with loss of power in the lower extremities. His general health gradually improved, but with loss of speech and defective intelligence. He was sent to England, arrived December 24th, 1878, and was admitted into the Asylum at Ealing, suffering from dementia. He had recovered the use of his limbs, but his

mental power was weak. He has improved considerably, but lately tonic contractions of the extensor muscles of right arm have set in, so that I am led to think there is mischief connected with the centres relating to the arm. Still under treatment."

Case 14.

"J. M., an officer, aged forty-three. Was much affected at the loss of his wife, and while at Pulney, in the year 1868, had coup-de-soleil from direct exposure, followed by headache on the left side, difficulty of articulation, and other signs of cerebral disturbance; this was followed by singing noises in the left ear, and defect of vision of the left eye from dilatation of the pupil, followed by great contraction. The memory became defective of recent events, and an eccentricity of conduct and manner became evident. Exaltation of ideas, great excitement, and a loss of control, was followed by excess of depression. He was placed under appropriate treatment, but the symptoms of violence and aberration increasing, as evidenced in striking those about him, and his wish to purchase property on a large scale, he was sent home, and came under my care at the Royal India Asylum, on August 25th, 1870, suffering apparently from general paresis. His ideas were exalted and bombastic; expression of face unhappy and perplexed; tongue tremulous and quickly receding; pulse varying from 76 to 93; temperature also from 96·8° to 99·6°; gait unsteady and tripping. These symptoms continued till about August, 1872, when there was a great improvement; he became more rational and his walk more steady, so that he was enabled to leave the asylum, and resided for the following two years in Scotland. I saw him occasionally during this time; he lived temperately, and as far as I could learn had not shown any signs of venereal excess. He took interest in various things, and played golf, thus of course taking a large amount of exercise. On November 5th, 1874, he was readmitted. At this time

he is noted as suffering from the second stage of general paresis, very indistinct in speech, and labouring under extravagant and exalted delusions that he is to play a great part in India, that he is very rich, etc. His pulse was small and quick, pupils strongly contracted, and temperature normal. Was treated with Ex. Physostig. gr. $\frac{1}{4}$ three times daily. The symptoms gradually increased in intensity, and the paralysis became more marked till the beginning of December, 1878, when he took to his bed. From this time I believe contraction of the lower extremities set in, and the limbs became strongly flexed towards the chin; he became rapidly worse, and died, January 27th, 1879, from exhaustion. He took food freely to within a few hours of his death.

"Post-mortem examination, as regards the head only, was made about sixteen hours after death, and the following observations made:—Rigor mortis persistent; body much emaciated; calvaria strongly adherent, the plates dense; diploë obliterated; membranes very vascular, thickened, and adherent to the surface of the brain along the median fissure: this was found on separation to be caused by three or four bony plates, of the size of a sixpence, with small spiculæ passing into the surface of the brain on the left side. The brain was smaller than usual, and weighed only forty-four ounces; the grey matter was deficient, and the convolutions flattened, and apparently not so numerous. Nothing unusual appeared in the substance of the brain beyond very slight softening in the right thalamus opticus.

"Great interest occurs from the close resemblance at the autopsy to the facts observed in a brother's case, plates of bone being there found as large as a shilling. The brother had never been in India, was not the subject of coup-de-soleil, and yet the disease ran somewhat the same course, but was of shorter duration."

DENGUE.

Under the synonyms of Dengue, Scarlatina rheumatica, Exanthesis arthrosia, Dandy fever, Three-day fever, Red fever, Break-bone fever, Broken-wing fever, Stiff-necked fever, Tootiah (Bengal), Eruptive articular fever, an infectious, eruptive fever, commencing suddenly, remitting, and liable to relapse, is described. The symptoms are severe pain in the head and eyeballs, swelling and pain in the muscles and joints, which are prone to shift suddenly from one joint to the other; catarrhal symptoms, sore throat, congested conjunctivæ; swollen submaxillary glands, and an eruption commencing on the third day but of short duration—twenty-four to forty-eight hours. There is great prostration and debility, and it is characterized by intervals, remissions, and relapses, which may continue over some weeks. Cachexia and arthritic pains are liable to be protracted, and convalescence to be tedious, but it is rarely fatal.

It occurs epidemically and sporadically in India, Burmah, Persia, Thibet, Arabia, Egypt, and other parts of Africa, North and South America, and the West Indies, but is unknown in Britain, at all events as an epidemic, though Dr. Richardson has described certain cases of so-called scarlet fever combined with acute rheumatic fever, for an account of which we were first indebted to Dr. Golding Bird, which seems to be identical. Drs. Kelso and Ross have noticed a similar supposed conjunction of the scarlatinal and rheumatic disorders. Dr. Richardson also describes certain cases observed near London (Barnes Green) in which four children

suffered from fever, with an eruption, combined with pain and swelling of the joints, particularly of the wrists, ankles, and knees. In two of these cases there was endocardial mischief and albuminuria. They all recovered. These, however, Dr. Richardson describes as scarlatina and rheumatic fever occurring simultaneously in the same persons. Dr. Willen also notices similar cases.

Dr. T. E. Charles, who has given an account of the epidemic of dengue of 1871-72 in Calcutta, says:—"I have nowhere seen any trustworthy evidence of dengue having occurred in Europe in any country except Spain." In 1865-67 Andalusia and other provinces were severely visited by it. Paggio, who published an account of dengue in 1871, alluded to a very similar epidemic having prevailed in Cadiz and Seville between 1764-68. If this really were dengue, the notice is the first reliable one that we have of the disease.

Dengue is endemic in India, and cases occur sporadically every year in Calcutta. It is known there as the red fever (E. Goodeve), and spreads epidemically over India at long intervals. A most severe visitation occurred in 1824, which extended to Burmah; another in 1871-72. Of 2,324 persons employed by the Government and East India Railway offices —Europeans, Eurasians, and natives—during the latter, 1,636 suffered from the disease, over 70 per cent. being attacked. It spread over the whole of India. Similar epidemic waves of the disease have occurred in other countries.

In 1780, on the Coromandel Coast, the native population were attacked, though none died.

In 1779 Gaberts describes a severe epidemic which raged in and round Cairo. It recurred there in 1845, and in 1871 at Port Said, and in other parts of Egypt. Dr. Rush describes an outbreak in Philadelphia in 1780. Pezet one in Lima in 1818.

In 1826 it prevailed in Savannah; in 1827 at St. Thomas and Santa Cruz; thence it spread to North and South America and the intervening islands. In 1828 it passed

epidemically over New York. In 1848 New Orleans and part of the Southern States were affected; in 1850 it prevailed severely in the Southern States.

On the west coast of Africa, St. Louis, Senegal, it prevailed severely in 1845-48, 1856-64, and then in the Canary Islands.

Epidemic visitations of dengue, extending over wide tracts of country, occur at long intervals, and probably depend on certain unknown atmospheric and cosmic conditions that favour its development, under which a single sporadic case is "sufficient to sow the disease broadcast over a wide extent of country, and, as the intervals are generally long between each, it finds a virgin soil in which to germinate."

The epidemic of 1871-72 which spread over India, it has been suggested, may be attributed to extension from sporadic cases occurring in the country, and to importation from Arabia; the last theory being supported by the fact that the Jewish community in Calcutta, among whom it first appeared, have close commercial relations with Arabia. This may be the case if the disease existed, as it appears to have done, about that time, or a little earlier, in Arabian ports. It appears to have been imported to Aden in 1871 from Zanzibar, where, previously to this, it had been epidemic.

The characteristic features of dengue are the presence of severe continuous arthritic and muscular pains, great debility and prostration, the occurrence of an initial and a terminal rubeoloid or scarlet rash; fever which is subject to remissions and relapses. Convalescence is frequently tedious, painful, and complicated by the continuance of general cachexia, pain and swelling of joints, enlargement of glands, orchitis, weakness of eyes, deafness, diarrhœa and dysentery of a chronic and intractable character; hepatic derangement, boils, carbuncles, and even insanity have sometimes been a sequel. Uterine hæmorrhage and miscarriage may occur.

The invasion of dengue is generally sudden; the patient

may have felt well up to the period of attack, the earliest symptom being severe pain in a joint, probably of a finger, which rapidly extends to all the other joints and bones; these pains during the progress of the disease often pass from one joint to the other by a sort of metastasis.

There may be a period of preliminary malaise, of one or more days, marked by anorexia, a sense of weariness and languor, chilliness, sometimes amounting to rigor, severe pain in the head, perhaps confined to one region, or in one or both eyeballs; pains in the body, limbs, and joints, notably of the fingers and toes; giddiness and nausea; but the attack is often quite sudden, and without any premonition, as was frequently seen in the last Calcutta epidemic, commencing with violent arthritic pains, with swelling of the joints, or severe pains in the head and eyeballs, neck and back. In some epidemics certain phenomena are more prominently marked than others.

Fever, accompanied by redness of the face, which is puffy and swollen, sore throat, congested conjunctivæ, a general redness, like the scarlatinal rash, extending over the whole body. Tongue red at tip and edges, loaded with white fur, through which red papillæ protrude, rapid pulse, from 102 to 120 or even 140, hurried respiration, temperature rising to 103° or even 105°, mark the occurrence of the initial fever and rash. These periods last from one day to forty-eight hours; the rash then disappears, the fever subsides, and the remission lasts for a period of two, three, or four days, when a recurrence of febrile symptoms takes place; and with it a second, the terminal, rash, differing in character from the first, and resembling a rubeoloid or even urticarial eruption, often appearing first on the palms of the hands, and in some cases causing profuse desquamation of the cuticle, though the rash is so slight as to be sometimes barely perceptible. These gradually subside, leaving the patient weak, exhausted, and often still tortured by swelled and painful joints, especially the smaller ones, which often continues for a period of weeks, making convalescence tedious and painful; or there may be

repeated relapses, prolonging the suffering, and protracting recovery.

The symptoms vary in different cases, both as to the character of the rash, the temperature, and the muscular or osseous pains.

The rash not only varies considerably in colour, character, and duration, but it is sometimes almost absent; in some cases it is attended with so much hyperæmia and action of the skin that excessive desquamation results.

The hyperæmia also sometimes expresses itself by hæmorrhage from the mouth, nose, bowels, and uterus.

The fever is sometimes accompanied by delirium, or in children by convulsions; in the latter, indeed, these occasionally initiate the disease.

The distinction betwixt scarlatina and dengue is well marked, though during the outset there is considerable resemblance between the two diseases. There is a high temperature at first in both, but it is more quickly attained, and is transient, in dengue; in scarlatina it endures for several days, whilst in dengue the fastigium gives a temperature of 103°, even up to 105° or 107°; this being attained it rapidly declines; it then is exceptional to find a temperature above 102° maintained in dengue.

In scarlatina the period of decline extends over several days, and is marked by slight exacerbations in the evening. In dengue it occupies a few hours, and the temperature may even fall below the normal standard.

The severe muscular and arthritic pains of dengue do not occur in scarlatina; and the pulse in the latter is much more rapid in the early stages than in the former. The initial rash in dengue occurs sooner than the eruption in scarlatina.

Dengue occasionally assumes a malignant form, where the amount of poison received has been overwhelmingly large. "Drowsiness may have passed into coma, and the temperature verges on the hyperpyretic, a failing heart and œdematous lungs, with a whole surface highly cyanotic; these cases have been popularly termed 'black fever,' and are justly much dreaded."

Happily such, however, are rare. Again, there are very slight forms, in which the patients are scarcely ill, and where it is not easy to decide as to the exact nature of the disease. "A trifling sore throat and slight malaise may be all you can detect till the terminal rash appears to show what you have to deal with; even this may not be seen."

An attack of dengue does not confer absolute protection from a recurrence of the disease, though it does so to a great extent; there can be no doubt that many persons during the last Calcutta epidemic suffered more than once. It certainly is infectious, as has been proved by many examples of its having been conveyed from person to person. The period of incubation is probably from five to six days; it may be a day or two more or less in some cases. Relapses are frequent, and the patient may suffer more than even a second or third before recovery.

In simple and uncomplicated cases the average period for the duration of the disease may be taken as about eight days; but it is frequently prolonged over weeks, and the recovery is slow and painful, the constitution often being so much shattered that complete restoration to strength and vigour does not occur for months.

Some of the sequelæ already mentioned remain, torturing the patient and retarding his recovery. Albumen is occasionally present in the urine; but it is not, as in scarlatina, especially in the cases of children, so frequent or so dangerous a result of the disease. Dengue attacks all ages, from the infant in arms to persons of extreme old age.

Treatment.—This is a specific fever, and has to run through a certain course. The treatment is simple, and if judiciously directed mitigates the sufferings and materially aids recovery.

Neither emetics nor active purgatives are necessary. They do no good, but increase the weakness and aggravate the suffering by the muscular movements necessarily induced. Moderate action of the bowels, followed by a warm carminative aperient, with an occasional dose of calomel, rhubarb, or colocynth, especially if they remain confined, to which there

does not appear to be any peculiar tendency, though the alvine evacuations are dark and often slimy, and confined at the outset; salines, such as the acetate of ammonia, citrate of potash, with nitric-æther combined with aconite, are useful during the pyrexia. In cases of very high temperature, 105°, 106°, 107°, cold sponging is beneficial. The danger to life of such a high temperature during the great heat of the hot months in India is great; and it is then that the cold sponging or bath is indicated.

Belladonna seems to confer relief in this disease; ten to fifteen drops of the tincture may be given, and two or three such doses given at intervals of an hour will sometimes produce excellent effects and give much relief. The extract may be given if prepared in doses of one-third of a grain; or the juice in equivalent doses to those of the tincture.

For the pains and nocturnal restlessness, morphia or Dover's powder may be given; and, as external applications, liniments containing opium, belladonna, and chloroform are serviceable, rubbed on the spine, back, and joints.

Tonics, and a carefully regulated nutritious diet, are also indicated, and all spoliative or depletive measures must be avoided. The tonics should be of the bitter vegetable kind, such as gentian and calumba; with these may be combined a small quantity of quinine, with some mineral acid; and, in some cases, the dilute phosphoric acid, combined with nux vomica or small doses of strichnine, may prove useful.

As to wine, good claret is probably the best, but others may be given if preferred.

Quinine is given more for its tonic than its antiperiodic effects; though, where there is a tendency to relapse the judicious administration of five or even ten grain doses may be beneficial in arresting it. Bromide of potassium is recommended by some authorities, and especially when convulsions occur in children. Alkalies, colchicum, and other remedies in use in rheumatism have been found to have little, if any, effect in relieving the pains of dengue.

For the irritation of the skin, which is sometimes very

troublesome, the application of camphorated oils is recommended. Warm baths are likely to confer relief.

As is the case in so many other diseases of Europeans in tropical climates, complete restoration to health is likely to be expedited and promoted by change of air, and if the cachexia be severe after a prolonged attack of the disease, return to the patient's native climate for a season is desirable.

ON THE HEALTH OF EUROPEAN CHILDREN IN BENGAL.

Read before the Medical Society of London, 1872.

Infant European life and health in British India must always be a subject of interest, but is so especially now that the country is becoming so great a field for European enterprise; it is one, therefore, upon which accurate information is valuable. For where is the city, town, village, or community—I might almost say family—in England in which some one does not look anxiously for the arrival of the weekly mail bringing tidings of relatives or friends in India? This interest is daily increasing among all classes, not only from the extension of our Indian empire, but on account of the impulse recently given to various industries, and the continuous development of the resources of that country, which is giving employment to so many of our countrymen.

The European population is rapidly increasing in India; all that concerns its life and health must therefore be of great importance. As the missionary, the schoolmaster, the railway, the telegraph, and the printing-press exercise their inevitable influence on civilization and on the development of the intellectual and physical resources of the country, so an increasing tide of labourers is attracted from the West, for although native agency and labour are mainly relied on, European supervision and skill are indispensable.

The condition of the Anglo-Saxon in India during the last half-century differs from that of an earlier period, when Europeans not in the covenanted service of the Honourable East India Company were styled interlopers and adventurers, and were permitted to remain in the country only on sufferance, being at any time liable to expulsion.

The position of the European then in India was not that of the present day. In some respects, perhaps, he had greater, but in many he had fewer advantages than his successors. If he had the opportunity of gaining greater wealth, or power, and of leading a more luxurious life, his voyage to India was seldom accomplished by the long and tedious sea route round the Cape in less than from four to six months. If on his arrival in the country he found himself placed in a post of considerable responsibility, dignity, and emolument; and if his life were one of Oriental luxury—a condition, by the way, which is grievously over-rated—he was cut off from his family and friends, his communications with them being so few and at such long intervals that he gradually became isolated from home and its influences; and the expatriation was conducive neither to his moral nor his physical welfare.

All this is altered now. He reaches India in three weeks; he goes, if he will, from Calcutta to Simla in as many days; or, if he feel so inclined, he may take leave, spend half of the time in China or England, and be back in India in three months—in less time than it formerly took him to go from England to Calcutta. The moral and social atmosphere in which he lives has improved: he is more under the influence of home interests and impressions, and in all respects his life is different from that of the Anglo-Indian of former days. He can have weekly communication with home by post, daily by telegraph; new books, periodicals, reviews, journals reach him but little later than if he were in the reading rooms of remote parts of the United Kingdom. He has whatever is novel in art, science, and literature—the railway, the telegraph, the penny (anna) post, gas, ice, theatres, museums, social and scientific societies, opera, clubs, circu-

lating libraries—as he might have them in England; not quite so good, perhaps, but still sufficient to make life in India as tolerable as heat, malaria, damp, mosquitoes, and the dread of cholera will permit.

Much good seldom occurs without some concomitant evil, nor have we any exception here. The European resident in India is no longer confined to the covenanted *employé* class of former years. The so-called "adventurer" has multiplied: I do not allude to the merchant, planter, or tradesman; these, like their covenanted and uncovenanted brethren, are, as a general rule, well-to-do—free from the "*res angusta domi.*" I refer rather to the artisan and labourer on the railways, in factories, and engaged in other subordinate duties formerly performed by natives, and on whom the necessities of life press hard in a climate where the anxieties inseparable from the care of a family are added to the natural disadvantages of climate.

Among improvements, those of a sanitary nature have not been least important, for they are diminishing the death-rate and raising the standard of European health in India. I shall refer only briefly to statistics, for those who care to study this question further may do so in the sanitary reports published by the Indian Government. Sufficient for the present to say that European life is becoming more valuable than formerly. I speak chiefly from the experience of the British soldier—for, so far as I know, the most reliable health statistics are those relating to the sanitary condition of the army; but the improvement extends to all, and among others, to the children.

Dr. Cunningham says, "It may be observed that the experience of the year 1871 has, on the whole, been favourable. In the case of Bengal this remark is peculiarly applicable, for here in no year of which there is any accurate record has the mortality been so low." The death-rates in this Presidency for each year since 1858 are shown in the annexed statement, and the ratios for Madras and Bombay have also been included, so far as I have been able to obtain the required information.

STATEMENT SHOWING THE MORTALITY PER 1,000 OF AVERAGE STRENGTH AMONG EUROPEAN TROOPS IN THE THREE PRESIDENCIES DURING 1871, COMPARED WITH THAT OF EACH YEAR SINCE 1858.

Years.	Bengal.*				Madras.†				Bombay.‡			
	Cholera.	All other causes.		Total.	Cholera.	All other causes.		Total.	Cholera.	All other causes.		Total.
		In hospital.	Out of hospital.			In hospital.	Out of hospital.			In hospital.	Out of hospital.	
1858	9·16	91·39	10·52	111·07	§	..	..	..	§	..	..	..
1859	8·67	35·30	1·38	45·35	..	..	..	..	..	..	..	..
1860	12·04	24·14	·59	36·77	..	19·1	2·04	21·14	..	..	..	31·70
1861	23·73	21·06	1·14	45·93	..	14·5	1·8	16·3	..	..	..	24·72
1862	9·61	17·44	1·06	28·11	..	17·09	1·7	18·16	..	..	..	24·60
1863	4·09	18·85	1·18	24·12	..	16·5	3·01	19·51	..	..	..	16·14
1864	2·55	17·39	1·16	21·10	..	16·5	3·6	20·1	..	14·4	1·5	15·9
1865	3·12	20·40	·72	24·24	..	19·5	2·9	22·4	16·0	17·8	1·3	35·1
1866	1·37	17·34	1·40	20·11	2·3	17·9	1·5	21·7	0·6	10·7	1·4	12·7
1867	13·84	16·16	·95	30·95	0·36	15·34	2·3	18·0	5·0	12·4	1·9	19·3
1868	1·81	16·94	1·36	20·11	0·5	15·8	3·0	19·3	0·8	12·1	1·0	13·9
1869	16·46	24·98	1·45	42·89	2·2	18·8	2·3	23·3	5·2	13·7	2·5	21·4
1870	·63	19·74	1·53	21·90	3·5	13·4	2·3	19·2	0·1	15·3	1·3	16·7
1871	·71	16·07	1·05	17·83	3·32	15·40	1·38	20·10	·09	13·10	·83	14·02

"The death-rate for Bengal in the past year—17·83 per 1,000—although lower than it has ever been previously, is still above that which has been attained in Bombay. The marked fluctuations in the Bengal mortality, chiefly due to cholera, contrast, as a rule, with the comparatively steady proportion of deaths in both Madras and Bombay."

The death-rate of British troops in India in 1871 was only 17·83 per 1,000; of officers 12·49 per 1,000.

* From Dr. Bryden's tables.

† From 1860–70, Sanitary Commissioner for Madras, Report for 1870, page 2; for 1871, Dr. Bryden.

‡ From 1860–63, Army Medical Reports; 1864–70, Report of Sanitary Commissioner, Bombay, for 1870, page 12; for 1871, Dr. Bryden.

§ The proportion of the deaths due to cholera in the Madras and Bombay Presidencies cannot be shown for the early years. The figures in these columns have been supplied by the Sanitary Commissioners.

According to Mr. Townsend—

MORTALITY OF TEN YEARS—1860-69.

	Max	Min.	Mean.
Men	45·93	20·11	29·98
Women	68·03	25·46	43·31
Children	145·22	71·36	94·90

1870.

	Strength.	Deaths per 1,000.
Men	33·373	21·90
Women	3·519	32·68
Children	5·644	81·68

DEATHS OF CHILDREN PER 1,000.

	England. Mean of 29 years. 1838 to 1866.	Bengal Presidency. 1870.
Under 5 years	67·58	148·10
5 and under 10 years ..	8·80	17·73
10 ,, 15 ,, ..	4·98	11·51

It has often been asked if the Anglo-Saxon can colonize India—*i.e.*, can the race, unsupported and unrecruited from home, continue to reproduce itself and exist there? Can he, in short, do in India what he has done in America and Australia—establish himself, take root, continue his race, people the country, and of course in so doing displace, or rather replace, the native races who have become acclimatized during an occupation of many centuries? I think not. But if asked, Why not? I must admit that I have no proof to give that it would be so, and have only impressions to offer in support of the conviction, as the data for framing a precise reply do not, so far as I know, exist. I am not aware that the opportunity of testing the vitality and durability of the Anglo-Saxon race cut off from all communication with its own country or with the indigenous races has ever occurred; but I feel

convinced that, had India been colonizable by the European, his position would have been very different to what it is now. This, however, though a curious and important subject of inquiry, is not that now to be discussed. I desire to consider, not whether the Anglo-Saxon can colonize India, but can he rear his children—the first generation—in that country, and with what prospect of success?

Sanitary science is doing much: life is being prolonged; health and the conditions of existence are improving; the European who leads an ordinarily temperate and careful life has expectations of living perhaps little below those he might have had in England. But still in a tropical or sub-tropical climate, he is liable to certain serious and sudden diseases; he incurs a risk which has been estimated by insurance societies to imply greater danger to life than in England.

It is not of himself that I now wish to speak, but of his children, and especially of those whose parents are unable, from any cause, to send them to Europe for nurture and education. What are *their* chances of life and health, if brought up in India?

For the rearing of European children in India much has been done during the last half-century. The necessity for proper schools, and establishments where not only their physical but their moral health would be cared for, has been the subject of serious thought and action on the part of many benevolent persons in India, and has led to the establishment of schools and orphan asylums in the presidency and other towns and hill-stations, which have done much good. The various orphan asylums and schools in Calcutta—the Lawrence Asylum at Sanawar, and the Bishop's schools in the hill-stations—will perpetuate the names of Claud Martin, Ellerton, Kidd, Sir H. Lawrence, Bishop Cotton, and others, as long as we remain in India.

In these institutions the problem of infant health and progress in India is solved to a certain extent; but as a reply to the question of the value of European infant health,

it is only partially satisfactory, for the reason that, in the first place, some of the schools are situated in the hills, in an almost European climate; and in the second, that the children are often of mixed parentage.

The introduction of the native element of course modifies the value of the statistics. But an opportunity does exist in Calcutta of studying this very important question, and it would hardly be possible to imagine one better calculated to furnish the data required.

In or about the year 1815 an asylum was founded in Calcutta for the female orphans of Europeans of the poorer classes in India, and the original reasons for it are set forth as follows in an annual report of the institution:—

"It has long been observed, by persons whose situations have enabled them to know the state of the children in the King's European regiments in this country, that those who become orphans at a very tender age, being usually left in the charge of careless nurses, are in many cases altogether unprovided with nurses, are very seldom reared to maturity, through the ignorance, indolence, and cruelty of those who are entrusted with their management. An asylum, therefore, for the reception of such orphans would tend to the preservation of many lives which are now lost through the neglect or mismanagement of nurses, or the want of nursing altogether.

"1. This Asylum is established for the reception and education of female European orphans generally, but especially those of the King's regiments in India.

"2. Those children only are admissible whose fathers and mothers are both Europeans.

"3. The objects of this charity are admitted under ten years, or whenever they become orphans, at however early an age.

"4. That destitute children deprived either of one or both parents be eligible to the benefits of the institution, until the number reach to the amount of one hundred."

Originally intended for the orphan children of soldiers in

the King's regiments, the only class of Europeans then in the country whose circumstances were so poor as to render it impossible for them to make provision for their children in case of death, it has of late years become of much wider application, for the class of Europeans who may require such a provision for their children is, and has been, as I have before said, increasing, and for many years a large proportion of its inmates have not been the children of soldiers only—these being for the most part provided for by the Lawrence Asylum, or by other institutions founded of later years.

I would remark that this European Orphan Asylum differs from all the others in this respect, that it extends its benefits to children of pure Europeans only, any mixture of native blood rendering the child ineligible. The question of the growth, nurture, and vital statistics of the *Eurasian* child is one of great interest also, but with that I am not now concerned.

It is this which gives it such value in studying the influence of climate on the growth and development of the European child, and is the reason why I have selected it as the ground on which the following remarks are based. The report commences in January, 1863, and is continued up to May, 1871, or for more than eight years, but the previous history for many years as related by the Secretary and confirmed by letters from Drs. Jackson and Webb is included.

It appears from these records that about 130 individuals have been under observation during this period, ranging in age from one year to eighteen years—a daily average of about sixty-five girls. There have been six deaths—one in 1863 from dysenteric diarrhœa, one in 1865 from mesenteric disease, one in 1866 after amputation, one in 1866 from convulsions in teething, one in 1868 from typhoid, and one in 1868 from pulmonary disease.

The immunity these children have had from the diseases peculiar to the country, and from any of a severe kind, is remarkable. There has been during the period under

report, and for many years previously, no cholera, no diphtheria, scarlatina, croup, pleurisy, pneumonia, ophthalmia, typhus, phthisis, severe malarious fever or its complications, no dengue, and no malarious cachexia. The diseases have been—a few cases of dysentery, one only fatal, in a child (a mistress died of that disease); a few cases of diarrhœa, simple fever, febricula; a few cases of typhoid, one death, slight rubeoloid, slight hooping-cough; a few cases of modified small-pox—varicella; some catarrhal and bronchial affections; herpes, abscess, stomatitis, slight conjunctivitis, convulsions, simple sores. It would be difficult to find better results anywhere!

The sanitary history of this institution during the past six years is as gratifying as it has been during previous years, and is not less remarkable for the absence of disease than for the generally vigorous state of health enjoyed by the girls. The admissions into hospital show that there has been exemption from epidemic disease of any severity, and the very low mortality, as well as the small amount of sickness, proves that the European child, under proper hygienic conditions and careful physical training, may live and thrive in the plains of Bengal *almost* as well as in its native country. This is manifested also by the vigorous, healthy appearance of the children generally, and was conspicuous at the last yearly distribution of prizes, when it is no exaggeration to say that their appearance would have borne comparison with that of the girls in any similar institution in Europe.

For this very satisfactory state of matters, thanks are due to the careful and judicious management of the Ladies' Committee, who have supervised the institution, and especially to the lady superintendents, who have so vigilantly watched over the moral, mental, and physical education of the pupils.

It is impossible to over-estimate the advantages of their management; the high state of efficiency of the school, as well as the continued good health of its inmates, is mainly due to their admirable management.

DISEASE DURING SIX YEARS: DAILY AVERAGE ABOUT SIXTY-FIVE CHILDREN.

Abscess	2	Lumbrici	1
Adenitis..	2	Marasmus	2
Anæmia	1	Œdema	2
Aphthæ	1	Operatio	1
Bronchitis	1	Parulis	2
Catarrh	24	Pleurodynia	1
Cephalalgia	1	Pneumonia	1
Conjunctivitis	5	Rubeoloid	29
Convulsio	2	Scabies	3
Curvature of spine	1	Sprained ankle	2
Cynanche	3	Stomatitis	3
Debilitas	3	Subluxatio	1
Diarrhœa	81	Torticollis	1
Dysenteria	15	Tuberculosis	1
Dyspepsia	16	Tumor	1
Febris (simp.)	77	Ulcus	3
Febris (typhoid)	2	Vaccinia	2
Febricula	5	Varicella	4
Furunculus	33	Variola	2
Herpes	49	Vulnus capitis	2
Icterus	2	Vulnus digiti	1

There are several points of interest in the sanitary history of this school. First I would remark on the absence of any severe form of epidemic disease. In looking over the monthly abstracts of admissions into hospital, I find that there has not been a single case of cholera; and but one death from dysentery, the disease peculiarly to be dreaded in Calcutta, in the case of a girl, aged five years, which occurred in 1863, and was rather a case of dysenteric diarrhœa in a naturally delicate child.

With reference to the class of disorders peculiar to early womanhood, I may say that nothing could be more favourable, and that although there are certain indications of the influence of climate in either accelerating or modifying the usual functions, the state of health of the girls in this respect is most satisfactory.

The disease returned as measles was a rubeoloid fever of a mild form, slightly contagious, showing little tendency to spread, which has occurred from time to time, and has not been followed in any case, by those grave sequelæ that so frequently result from measles in Europe.

Two cases of modified small-pox are recorded, but there has been no tendency in the disease to spread. The children have all been protected by vaccination, which has succeeded admirably.

Two cases of typhoid or enteric fever have occurred, one of which proved fatal in 1868, the case of a girl, aged five. The other forms of fever have been of the simple continued, or mild malarial form.

Two cases of convulsions have occurred due to dentition or to malarial influences.

Hooping-cough has been altogether absent.

A few cases of skin disease, of a simple and tractable kind, have occurred.

As might be expected among so large a number of children, strumous disease has not been altogether absent. One girl died from pyæmia in the Medical College Hospital after amputation of the thigh (the other thigh having been amputated a year before) for extensive disease of the knee-joint; another died from marasmus, the result of strumous disease of the mesenteric glands.

Of acute inflammatory disease, whether of the head, chest, or abdomen, there has been almost none.

Diseases of the liver or spleen, whether from malaria or other causes, have been also singularly few, if not altogether absent.

Pulmonary and bronchial complaints have been very rare and slight; in one case of capillary bronchitis with atelectasis, a child, aged fourteen months, who came in ill, died a week after admission; there were a few slight catarrhal attacks involving the bronchial tubes only.

The number of children under two years of age has been small, and therefore it is not to be expected that the diseases of dentition should occupy a marked place; indeed, they have been almost altogether absent. The cases of convulsions recorded were due more probably to centric irritation or the influence of malaria on the nerve-centres. But the evidences of malaria have been, on the whole, very slight, as might be seen in the fresh colour and red lips of the children.

I would here remark, in proof of the improved sanitary condition of the girls, that lateral spinal curvature, of which ten years ago there were several cases, has now disappeared from the school. There can be no doubt that the very satisfactory state of health enjoyed by these children is mainly due to the sound hygienic arrangements, and the moral as well as physical discipline under which they live. They inhabit a well-built, ventilated, and commodious house, surrounded by a large open space of garden or ground, in which they find amusement and healthy recreation in gardening, or play in the open air. The nature of their occupation is such as to conduce alike to their moral and physical well-being. They have sufficient mental labour to develop without fatiguing their intellects, and of a character suited to the sphere of life in which they are intended to live. With this is combined methodic occupation of a fitting character, regular hours, a good but plain and nutritious diet, and good water; whilst all that could tend to injure the health from overwork of any special kind is strictly avoided.

The following statement of their daily occupations, diet, and recreation by the Lady Superintendent, explains how the time is passed; it is a system that might well be adopted by other educational establishments.

Diet.—Three regular meals in the day, and bread early in the morning. Breakfast (half-past nine), bread and milk. Dinner (half-past two), meat every day for girls above twelve, and three times a week for those under; dhall and rice, etc.; fruit three days in the week. Supper (half-past seven), bread and milk. The milk is pure; no water with it.

Habits.—All through the year the children rise at five a.m., bathe in cold water, and then take exercise in the compound.

Occupation.—During the cold season school commences at seven, and in the hot weather at six a.m. Five hours of regular school, and one of study (preparing lessons) through the day. During the hours of recreation, skipping and active play are encouraged, and, as a rule, the children are

as active and fond of a good romp as children in England. In-door exercise consists of cleaning the house, which is all done by the girls. Calisthenic exercises every morning.

The conditions of a healthy mind in a healthy body are present, and the results show how much a just combination of mental and physical training will conduce to ensure a high standard of moral and physical health, even in Bengal.

In reference to the question of growth and development of the European child brought up and educated in Bengal, I may give the following illustration from the average measurements of five girls at sixteen years of age, which was—height, 5 feet 4½ inches; weight, 7 stone 11 pounds; girth of chest, 34·7 inches; girth of hips, 35·7 inches—a stature and weight which would probably not be much exceeded in Europe.

During the twenty-eight months from January, 1869, to May, 1871, the health of the school was excellent. Disease has been almost entirely absent; the general standard of health has been high. There has been no death. Only two cases of any severity have occurred; one of pelvic abscess, from which, after an operation, the girl recovered, and is now in robust health; another had typhoid fever rather severely, but recovered. I would notice one or two causes, which are, no doubt, conducive to health, and have recently been introduced. First, the children now all wear flannel, and have a blanket at night under the sheet on which they sleep; and, secondly, they drink the new filtered river water from the stand-pipe. The general good health that has prevailed is somewhat remarkable in a school of nearly seventy girls. In January, 1869, there was a slight outbreak of measles. Eight girls were affected, but there were no untoward sequelæ. Except the two cases already alluded to, there was absolutely no other disease in this year. In 1870 there were a few cases of varicella; and in July, two cases of typhoid fever; both recovered. There was no other disease during this year. Up to the date of the report (May 6th, 1871),* there has been almost no sickness, with

* This state continued until I left India in March, 1872.

the exception of a few very slight cases of hooping-cough. The disease was clearly imported by one of the girls who had been out on leave. The cases were mild, and it showed no inclination to spread. Throughout the whole period there has been no small-pox; the children are all protected by vaccination.

The following table shows the ages at which each of twenty-seven girls, all of pure European lineage, commenced to menstruate. It appears that seventeen were born in India, two in Ceylon, six in Europe, one in Australia, and one whose birth-place is not known. The earliest age at which the catamenia appeared was at 12 years and 2 months in a girl born in India; the latest at 16 years and 4 months in the case of a delicate strumous girl who died, after amputation (in the Medical College Hospital), of pyæmia; she was also born in India. The next latest was a girl born in England, in whom it commenced at 15 years and 8 months. Of the seventeen girls born in India, the catamenia commenced in two between 12 and 13; in five between 13 and 14; in eight between 14 and 15; in one between 15 and 16; and in one between 16 and 17. Of the six born in Europe, the catamenia commenced in one between 12 and 13; in one between 13 and 14; in two between 14 and 15; and in two between 15 and 16. Of the two born in Ceylon, it commenced in both between 13 and 14. One in Australia, between 15 and 16; and the one whose birth-place was unknown, between 12 and 13. Thus of the whole number—

Four	commenced	between	12 and 13	years of age.
Eight	,,	,,	13 and 14	,,
Nine	,,	,,	14 and 15	,,
Five	,,	,,	15 and 16	,,
One	,,	,,	16 and 17	,,

The column of remarks in the table shows how the functions were subsequently performed. This is interesting as showing how sound physical and moral training affect the European female born and brought up in India.

TABULAR STATEMENT SHOWING THE BIRTH-PLACE, DATE OF BIRTH, AND AGE AT WHICH THE CATAMENIA FIRST APPEARED IN TWENTY-SEVEN GIRLS OF EUROPEAN LINEAGE, EDUCATED AND BROUGHT UP (MANY BORN) IN INDIA.

Where born.	Date of birth.	Date of first menstruation.	Age.	Remarks.
India	March 3, 1851	March 13, 1864	13 years 10 days	Regular (left school).
India	October 20, 1850	April 1, 1864	13 years 5 months 11 days	Regular.
India	October 19, 1851	December 21, 1864	13 years 2 months 2 days	Irregular (left school).
India	September 28, 1848	February 10, 1865	16 years 4 months	Illness occurred twice (dead). Died March, 1867.
India	January 14, 1852	September 15, 1865	13 years 9 months	Regular.
India	July 27, 1854	October 10, 1866	12 years 2 months	Regular.
Ceylon	January 11, 1852	October 17, 1866	13 years 9 months	Regular.
England	November 11, 1852	December 3, 1866	14 years 19 days	Regular.
India	November 18, 1852	January 9, 1867	14 years 1 month	Regular.
India	April 23, 1853	January 12, 1867	13 years 9 months	Regular (left school).
India	June 9, 1852	March 27, 1867	14 years 10 months	Very irregular (left school).
England	June 18, 1852	November 5, 1867	15 years 5 months	Regular (left school).
Scotland	April 28, 1853	January 4, 1868	14 years 8 months	Regular.
India	January 7, 1853	December 28, 1867	15 years all but a week	Slightly irregular.
India	December 5, 1854	January 12, 1868	14 years 5 weeks	Regular.
India	August 12, 1852	February 1, 1868	15 years 5 months	Regular (left school).
England	May 15, 1854	March 8, 1868	13 years 10 months	Regular.
India	March 15, 1854	April 27, 1868	14 years 1 month	Regular.
Australia	August 10, 1853	September 28, 1868	15 years 1 month	Regular.
Ceylon	April 20, 1855	October 3, 1868	13 years 5 months	Regular.
India	May 5, 1854	October 11, 1868	14 years 5 months	Illness has occurred only once.
Not known ..	May 14, 1856	December 17, 1868	12 years 7 months	Regular and very profuse.
India	August 3, 1855	April 6, 1869	14 years 7 months	Regular.
India	May 25, 1856	February 6, 1869	12 years 8 months	Regular.
India	March 30, 1855	June 10, 1869	14 years 2 months	Regular.
England	December 21, 1856	June 12, 1869	12 years 5 months	Regular.
England	November 17, 1853	August 10, 1869	15 years 8 months	Regular.

I have known most of these girls since they were infants, and the impression I have formed is, that they are rather more precocious both in physical and mental development than girls of the same age in Europe. They are most carefully educated, and their training is most sedulously guarded. But the stimulating effects of a tropical climate assert their influence; and it appears that the girl of sixteen or seventeen is two or three years in advance of a girl of that age in a European climate. It is remarkable how few deviations have occurred from the natural and regular recurrence of the catamenia in these girls. As a rule it occurs regularly and without trouble, and any deviation is unusual.

In connection, though perhaps remotely, with this subject, I would note the occasional occurrence among the girls of a swelling of the lower extremities, evidently nearly allied to the elephantoid growth seen in the limbs of the natives of Bengal—a bucnemia. It is a steady and progressive enlargement about the ankle and leg, but extending slightly up the thigh itself, generally on only one side. If there be any change in the condition, it occurs at the menstrual period, when the limb is somewhat larger than at other times. The swelling is firm, not œdematous, and very like elephantiasis, except that it is not attended with either periodic pain or excitement in the parts, but is of very slow and steady growth. One of the finest girls (aged seventeen) in the school is affected by it, and the left ankle is more than an inch larger in circumference than the right, the swelling gradually extending to the left thigh, which is somewhat larger than the right. There is no pain and very little inconvenience, except that which is caused by the increased size. I have not, as yet, succeeded in making any impression on it by medical treatment, and but very slight—only of a temporary nature—by bandaging. These cases, I am happy to say, are exceedingly rare, as during the twelve years that I have known the school, there have been only two or three; they are very interesting, and their pathology requires further investigation.

My personal knowledge of the institution ranges over a period of twelve years—*i.e.*, from 1860 to 1872—and I have been, through the kindness of the Secretary, furnished with sufficient information of the early history of the school to show that it has always been equally satisfactory. The Secretary says, "I can't remember any sickly year with the above exception. I have known single cases of cholera, but none fatal; no outbreak of dysentery, but we have had single cases most years, but not fatal amongst the children. We lost two mistresses from death by dysentery, and one had to leave on account of that disease. I should say chronic dysentery, diarrhœa, and sluggish livers were the commonest ailments of the children. I never heard of diphtheria in the school. One of my earliest recollections of illness in the school was a very severe fever of the nature of typhus, I believe (which caused great anxiety), in a girl of ten, who became very delirious and lost her speech for weeks, but ultimately recovered, and no one else took the fever. My personal recollection of the European Female Orphan Asylum goes back to 1850. The only epidemic I remember besides measles and hooping-cough—one or other of which has visited the Asylum mildly every two or three years—was chicken-pock; in what year I can't now recall, but it must have been pretty general through the school, for I remember the chapel was filled with beds as an additional hospital, and there was some anxiety, from the idea that it was modified small-pox, but no deaths occurred." The following letters from Dr. Webb and Dr. Jackson confirm this:—

Letter from Dr. Allan Webb to the Secretary of the European Female Orphan Asylum—1852.

"Having had medical charge of the European Female Orphan Asylum during the years 1849, 1850, and 1851, I have had abundant opportunity of judging of its general healthiness, and comparing it with other educational institutions for children in Calcutta. It must be, to all connected

with this admirable institution, most gratifying to learn that the children are so healthy; that there is no institution in Calcutta surpassing it. I doubt if there be any in India more free from disease; and this happy result is attained—it must not be lost sight of—in children exclusively European in the climate of Bengal.

"But this testimony to the health of the girls generally is not limited to immunity from disease only, but comprehends that robust capacity for work and play which marks the well-being of a child. For this great blessing under Providence the children are indebted to the personal supervision of the Lady Managers themselves in all that appertains to diet, exercise, and the neatness, cleanliness, and order which are inseparable from the salubrity of a girls' school; the fine open grounds and large airy upper-room dormitories being very important adjuncts.

"The school has not been exempt from disease. There was a good deal of sickness in the earlier part of 1850, when small-pox and measles were raging in Calcutta, but the diseases were of a mild type in this institution; whilst of cholera I do not remember whether or not there was a single case, yet this is generally as common as it is fatal. The children were indeed wonderfully exempt from bowel complaints.

"Allan Webb, M.D.,

"Presidency Surgeon."

Letter from Dr. J. Jackson to the Secretary of the European Female Orphan Asylum—1853.

"I have great pleasure in sending you a short notice of the state of the health of the children in the Orphan Asylum during the last year, and it is a great satisfaction to be able to state that they have been altogether free from any of the ailments which commonly are observed in schools, and that during the whole of the past year, from the month of

February, when I commenced my charge, there has scarcely been a sick child in hospital.

"This is attributable, no doubt, in some measure to the children all being of European extraction, but more especially is it due to the kind and judicious management which is bestowed upon them, to the regularity of habits, goodness of their diet, and the great attention paid to cleanliness and ventilation; and I consider it impossible to find an equal number of children in a better state, or more healthy condition, in any similar institution.

"J. JACKSON."

Reference to the later reports shows what is much to be regretted—that notwithstanding its usefulness, this institution has rather fallen off in numbers of late years; that, whereas in 1853 there were eighty inmates, the number has decreased to sixty-five in 1872. Of course this is partly accounted for by the existence of other institutions; but, considering the increasing wants and the advantages of this institution, it is matter of regret that there should be any falling off at all.

How much the value of infant life is affected by climate and the circumstances under which it is placed, may be seen by comparing the statistics of death of European children in England, and soldiers' children in the Bengal Presidency, for which I am indebted to Dr. Townsend, Sanitary Commissioner of the Central Provinces of India, and by the statements which I have extracted from a report of March:—In 1871 there were nearly 11,000 soldiers' children in India, of whom 425, or about 5 per cent., were sick every day, while 794, or upwards of 7 per cent., died. The mortality, therefore, of children is thrice that of adults. Judging from the experience of 1871, the risk of life in the Bengal and Bombay Presidencies in each 100 European children is stated as follows:—Thirty-three die under 6 months, twenty-two die between 6 months and 1 year, nineteen die between 1 year and 18 months, eleven die between 18 months and 2

years, two die between 2 years and 3 years, one and a half die between 3 years and 4 years, and one between 4 years and 15 years. At this rate it is remarked, that out of 100 babes, scarcely eleven would reach maturity.

For example, in 1,000:—

	England, the mean of twenty-nine years.	Bengal Presidency, 1870, by Report.
Under 5 years	67·58	148·10
5 ,, to 10	8·80	17·73
10 ,, to 15	4·98	11·51

—or more than double. Now, that this mortality is due to some extent to preventible causes, and not merely to climate, I think is tolerably clear, if compared with the death-rate of the European Female Orphan Asylum, where a similar class of children under better conditions gives such very different results. I am aware that statistics are only reliable in very large numbers, but I believe that the life of the European children in barracks in India is not so safely guarded against evil as might be, and that, despite all the care and attention they receive, they are exposed to influences detrimental to life and health, from which these orphans are exempt.

Miss Nightingale says justly, "Children are, as it is well known, the very touchstone—the live tests—of sanitary conditions, or sadly, but too often, the dying and dead tests of *insanitary* conditions."

That infant life and the preservation of health is peculiarly influenced by the hygienic conditions under which it exists, is proved by such facts as those I have narrated in reference to the European Female Orphan Asylum, and I would here remark that it has been shown to be equally so in England.

I am indebted to Mr. E. Chadwick, C.B., for the following remarks, in connection with the half-time school-drill review held on July 25th, under the auspices of H.R.H. the Prince of Wales and the Society of Arts:—

"MORAL RESULTS.

"The great body of the children reviewed are orphans or

deserted children. Under the old system of Poor-law administration, the children of this class, brought up in the workhouse long-time school, in contact with aged and vicious paupers, were turned out at thirteen or fourteen, bodily and mentally inapt for steady industry, and not above one out of three got into a place of self-supporting industry. Full 60 per cent. went to 'the bad,' on the streets as mendicants or thieves, the girls as low prostitutes, and they furnished the largest contingents to the population of the prison. These moral failures were attended by pecuniary waste, for all were supported by the ratepayers, either as mendicants or thieves, or as expensive prisoners. But now, under the improved mixed bodily and mental training of these half-time schools, the known failures and waste do not exceed 3 per cent. The great mass of the boys brought under review may be beheld with confident satisfaction as victims rescued from 'the bad,' and preserved for the good, as honest, self-supporting producers, and worthy members of the community. But although much of this success will be due to the bodily and industrial aptitudes imparted, and the work of the drill-master displayed, yet much of it will be due to the ministrations of the school chaplains, not alone in religious instruction, but in secular care and service, seeing that they get fitting places (especially girls), visiting them there, advising them, and corresponding, and acting *in loco parentis* to all the fatherless and the motherless.

"SANITARY RESULTS.

"It has been shown, as respects the common schools, where filthy-skinned and dirty-clothed children are often crowded together in ill-ventilated rooms, in miserable conditions, they are the common centres of children's epidemics. The old workhouse schools were subject to murderous epidemics. But now, by the application of rudimentary sanitary science, they are made normal examples of what may be done by it. Of this, one of the schools from whence the children were sent to the first review may be cited as an

example. Some years ago, the death-rate was 10 and 11 per 1,000. The drainage and ventilation were improved, and it was then brought down to about 8 in the 1,000. Next, more complete personal ablution and a swimming-bath were established, and the death-rate was reduced to about 4 in the 1,000. All the district schools, the elder of whose children will be reviewed, are to some extent children's hospitals, and many children are taken in only to die or linger as hapless cripples for life. But—with the exception of some remains of ophthalmia—by better ventilation of space, by careful skin-cleanliness, and by bodily exercise, the 'children's diseases of spontaneous origin may be said to be banished, and the death-rates have been reduced to about 3 in the 1,000, or less than one-third of the death-rates prevalent amongst children of the middle and well-to-do classes. With such a general death-rate, producible by sanitary science, there would be upwards of 10,000 children saved annually in the metropolis. Without such sanitary precautions, new schools may be only extended centres of children's epidemics.' "

I think it will be admitted that no more delicate test could have been afforded on the question of the state of infant European health, and the chances of life in the climate of the plains of India, than this almost continuous history of a little community of about seventy European children—of all ages from one to eighteen years, educated and trained in Calcutta —for a period of more than half a century. The answer it furnishes to the question is more favourable than might be anticipated by those who have seen the evil effects of a tropical climate on infant life, and it shows that with care and attention much may be done that might be deemed impossible. The statistics of these children would, I know, compare favourably with those of any school in the world; and so far it is very satisfactory, for it demonstrates clearly that with care and proper training a European child may live, grow, be educated, and even thrive in the plains of Bengal. This must be a consolation to those parents who are unable to send their children to Europe, or even to the

hills, and who otherwise must have the misery of feeling that their children were sacrificed to the inevitable hardship of life in the plains. Having said so much, I have something also to say on the other aspect of the question.

I have no desire to prove too much, as I certainly should appear to attempt to do were I to advocate the theory that Calcutta or any other part of the plains of India is a *desirable* locality for the training and nurture of European children; such, indeed, would be as dangerous as untrue. For although the exceptionally favourable circumstances of the European Female Orphan Asylum show that the European child may thrive, yet it is certain that without favouring influences it will not do so; and the statistics of infant life in the British army in India, as I have also shown, prove not only that such is the case, but that the obstacles to success in the rearing of children are very great.

Moreover, the mere question of health and the acquisition of knowledge, are not the only considerations in the proper training of a child. It has long been known to the English in India that children may be kept in that country up to five, six, or seven years of age without deterioration; and in the higher classes of life with probably as little, if not less, danger to life than in England; for in some respects — as, for example, scarlatina, measles, hooping-cough, thoracic complaints, and even dentition,— they suffer less in India than in England. But after that age, unless a few hot seasons spent in the hills should enable parents to keep their children in India until a somewhat later age, it is undesirable to do so. The child must be sent to England, or it will deteriorate physically and morally — physically, because it tends to grow up slight, weedy, and delicate, precocious, and with a general feebleness not so easily defined as recognized—something expressed not only in appearance, but in the very intonation of the voice—morally, because it learns from its surroundings much that is objectionable, and has a tendency to deterioration, which can best be avoided by removal to the more bracing and healthy atmosphere of Europe.

For these reasons, I think it is right that European children born in India should be brought up in Europe. But, as I have before remarked, as it must often happen that parents are unable to meet the cost of doing this, it is satisfactory to know that the climate of the plains of India is not necessarily fatal, as I think is shown by the history of the European Female Orphan Asylum, which suggests that even more might be effected. I have no doubt that all that can be done in Calcutta under favourable circumstances could be, and is, done in the hill-stations; indeed, I have seen European children who have been born and brought up in these localities, who were not inferior in physical health to those who had been reared in Europe. These will continue to increase, as Europeans who are unable to send their children home become more numerous. Schools, I am glad to say, already exist, and their numbers will probably increase, and will be much appreciated,—for the hills of India promise to become a permanent home to planters, landowners, and even retired commissioned and non-commissioned officers. Still such stations, however, notwithstanding their excellent climate, are, I fear, too few, far between, and isolated to become the seats of real colonization.

I feel satisfied that Europeans residing in India who wish to do full justice to their children, should, although it involve separation for years, send them to Europe even in preference to the hills. But it is satisfactory to know that, for those to whom this is impossible, their children can be reared in the hills, or even in Calcutta may with care grow up and become fitted for life in India. I *have* seen the third generation of Europeans reared in Calcutta, but such are rare, and though there was no marked physical degeneration, yet there was that which would make one look with great misgiving on the prospects of a race so produced.

I am told that some life assurance offices charge 10 per cent. extra on the life of a European born and brought up in the plains of India. The same value, in fact, is

attached to his life as to that of the Eurasian. It might be difficult, perhaps, to justify this on statistical grounds, but it shows, at least, the feeling on the subject that exists; and I cannot help saying that generally I think it is right.

I have endeavoured to show that although the mortality among European children in India is, as a rule, very high, yet that under judicious management and proper hygienic conditions more favourable results may be obtained;—not that the European child can thrive and be reared as well in the hill-stations of India as in Europe, but that life and a very fair amount of health is possible, even in Calcutta, under *favourable circumstances*, and that those who must expect to rear children in India, need not despair even though their lot be cast in Bengal.

If anything I have said could encourage those who have already done so much, or others who, with the power, are only wanting the opportunity of doing more to aid in the protection of the child-life of their less fortunate fellow-countrymen whose lot has been cast in India, I should feel satisfied that this brief relation of my own experience on the subject has not been without a good result.

ON PRESERVATION OF HEALTH IN INDIA.

Addressed to the Royal Indian Engineering College at Cooper's Hill, May 17th, 1880.

It having been intimated to me that some information about the climate, mode of living, diseases, and best method of preserving health in India would be acceptable to you in the form of a lecture, I have great pleasure in undertaking that duty, and will endeavour to impart to you some of the experience that I have gained in such matters during a long residence in that country, and which will, I trust, both interest and instruct you.

Colonel Chesney has made some important observations that I venture to quote as the text of what I am about to say in reference to the important question of health, and what you should do in India to preserve it.

He says,—"I have been very much struck with the amount of sickness to which our young engineers appear to be subject. A certain excess over the English average is of course to be expected in India, and engineers in particular are subject to exposure and malarious influence in an exceptional degree, but the number of cases of ill-health among these young men seems to be altogether beyond what might be set down reasonably to these causes. It is probably due, in part, to their being very much detached. A young officer on going to India joins his regiment, and learns from his brother officers how to take reasonable precautions. So the young civil servant gets the advantage of the example of

his seniors at the station to which he is posted. But the young engineer very often has no such guidance, and loses his health before he has learnt prudence.

"The matter is one of some importance. The accounts which have lately come home of sickness among them is really distressing. And more than one of them, in writing to us here, has deplored his want of a little elementary medical knowledge, not only on his own account, but from his inability to treat his work-people with the most simple remedies when out with them alone in the jungle."

I am aware that to gentlemen of your education and attainments much of what I shall say may seem trite and common-place, but as it is best for my purpose to do so, I shall assume that you are practically unacquainted with the subject, and treat it accordingly.

Few people, I imagine, who have not been there, appreciate the importance, or realize the vastness of British India. Let me remind you of some prominent facts relating to the country in which your future career is to be spent.

That extensive portion of the British dominions which gives to our Queen the title of Empress, and is called "the brightest jewel in her crown," is the great central and southern promontory of Asia, lying between the fifth and thirty-fourth parallels of north latitude, and the sixty-sixth and ninety-seventh meridians of east longitude. It includes a portion of Afghanistan in the north-west, and part of the country on the eastern side of the Bay of Bengal, extending from Chittagong to Tenasserim as far south as the tenth parallel of north latitude, and has a coast line extending for more than 4,000 miles. It is about 1,900 miles from Peshawur to Cape Comorin; and about the same distance from Sudya—a frontier post in Assam, to Kurrachee, at the mouth of the Indus; from Bombay to Point Palmyras in Orissa it is 900 miles. The superficial area is above 1,600,000 miles, — equal to the whole of Europe, excluding Russia, — and three-fifths are directly under British rule.

The geographical boundaries are well defined, on the north by the Himalayas, a chain of stupendous mountains 150 miles in average breadth, the highest in the world, running north-west and south-east in a crescentic manner for 1,600 miles, with a mean height of 16,000 to 20,000 feet; Mount Everest and Kinchinjunga, the loftiest peaks, being 29,000 and 28,000 feet above the sea-level. This barrier, which separates India from Turkestan and Tibet, is crossed by passes 17,000 feet above the sea-level, nearly as high as the line of eternal snow.

On the north-west it is bounded by the edge of the plateau of Afghanistan and Beloochistan, and by the Suliman and other mountain ranges; on the north-east by the heights of Assam, dividing the drainage of the Brahmaputra from that of the Irawaddy. It is separated from Burmah and Siam by the Youmadong and other mountains, whilst its coasts have the Bay of Bengal on the east, and the Indian Ocean and Arabian Sea on the west.

This extensive but compact country has nearly two hundred and fifty millions of inhabitants, composed of races more numerous and ethnically distinct, and speaking languages more numerous and varied than those of Europe; whilst, from the nature of its physical geography and the extent of its area, it has every kind of climate, varying from that of the Torrid to the Arctic zone. The seat of the most ancient civilization, with a history that reaches far back into remote antiquity; possessing a fertile soil, lofty mountains, elevated table-lands, rich alluvial valleys, extensive desert tracts, and plains; noble rivers, extensive swamps, jungles, and magnificent forests; a rich Fauna and Flora, wealth of mineral, vegetable, and animal products, and many undeveloped resources; it has characters that invest it with peculiar interest, especially for those who spend the best part of life there, and on whom the responsibility of ruling it has fallen.

A country with such physical characters has many distinguishing features of climate that are strange to the Anglo-Saxon, who has necessarily much to learn before he

is acclimatized and adapted to his new home. The people and their habits, the animal and vegetable creation, even the diseases, differ from those he has hitherto known, and he makes acquaintance—let us hope, not in his own person—with malarial and liver disease, insolation, dysentery, cholera, and others that at times sweep over the country as destructive epidemics, whilst the conditions of life generally under which he exists differ from those of more northern regions.

Such is to be your home and the scene of your labours; it is a field that has, as yet, been only partially explored, but which offers prospect of a rich return to those who work in it. Now, to enable you to take advantage of this, health is essential; but I regret to learn that of those who have already gone there, some have suffered, in this respect, beyond what may fairly be ascribed to climatic causes alone. It is on this account that I am here to-day, for the purpose of assuring you that health, though more precarious than at home, is not necessarily so seriously imperilled as you might suppose, if only ordinary precautions be taken—to offer you, in short, some advice as to how you may preserve it, and avoid, or mitigate, whatever is injurious.

But, as having an important hygienic bearing on the subject, let me first say a few words on the climate, seasons, and some other matters that affect the health of Europeans generally in India.

The Englishman has naturally a great power of adapting himself to altered conditions of existence—to extremes of temperature, and to climatic change. Like some of the domestic animals he has taken with him, he exists, nay, thrives, among the ice of the Polar regions, or under the vertical sun of the Torrid zone. This power of endurance is often severely tested, but the strain is sometimes due more to himself than to his surroundings; still there can be no question that with care it may be much enhanced. It is reported of an Irish soldier that he said, in reference to the evil effects of climate on his comrades—"They eat and they drink, and they drink and they eat, till they die, and then

they write home and say it was the climate that killed them." The soldier was not so far wrong in his estimate of the share climate takes, though he put it "more Hibernico."

In these days of expeditious travelling, men are transported rapidly from one extreme to the other; the sudden change is itself a severe trial, and, if incautiously undertaken, may lay the foundation of a chronic intolerance of the climate. I shall never forget the suffering I endured on arriving in Calcutta in the end of April, when the thermometer was at 90° in a damp atmosphere, after leaving England in March in a snow-storm, with frost on the ground. I have often endured great heat before and since, but never felt it as I did on that occasion, when physical and mental energy were alike depressed and almost prostrated by the sudden change. I do not know when the exigencies of the service may require you to go to India, but I would say that it is very desirable that Indian life should commence, if possible, in the cold season; by so doing the prospects of tolerating the climate will be much increased. Let me say at once that a young Englishman starting with fair health, good habits, and freedom from tendency to organic disease, may live well and happily in India, find scope for the full development and exercise of his physical and intellectual energies, and return to England, after long service, able to enjoy life, and to work as well as others of his own age and, probably, not half his experience. But this will depend very much on how he has taken care of and adapted himself to the varying conditions of life in the tropics.

India, for our purpose, in regard to climate, may be divided as follows: 1st, The Himalayan, with Bhotan, Nepāl Gurhwal, and Cashmere dividing it from the 2nd, or Hindostan, which extends along the foot of the Himalayan range, and includes the alluvial plains of the great rivers Brahmaputra, Ganges, and Indus, with their numerous tributaries, and part of Central India.

3rd. Southern India, the Deccan—which consists of elevated plateaux, from 1,500 to 3,000 feet above the sea-level,

littoral plains, intersected by numerous rivers, mountain ranges, and isolated hills; the Vindyah chain, covered with forest vegetation, and its offset, the Satpoorahs, traverse the continent from the Western to the Eastern Ghauts (the former rising from 3,000 to 7,000 feet), which bound it on either coast. The climates of this vast territory correspond to latitude, elevation, and physical characters of the country. Northern India is extra tropical and less influenced than the Deccan by the periodic winds, which bring moisture more or less to the whole Peninsula.

The climates in which you may have to serve will, therefore, vary. In Northern India you may find yourself in one nearly as good as any in Europe; elsewhere, you may happen on that which seems barely compatible with life itself. Heat alone, however, is not the only objection, for almost everywhere there is added malaria, with whose effects all, sooner or later, are only too familiar. It is the cause of more sickness and invaliding than almost all other disease causes put together, and often never entirely ceases to manifest its effects on the constitution!—Life is maintained under more or less of a struggle, and I propose to show you how the contest may be successfully maintained.

The heat is also greatly modified by moisture, and the effects of a dry or a damp atmosphere at the same temperature are very different. Dry air in motion at the temperature of 100° is more tolerable than that at 75° or 80° when stagnant and loaded with moisture! The hot winds of Northern India are more endurable and often healthier than the cooler but saturated atmosphere of lower Bengal, or parts of Southern India. Varieties of climate need corresponding adaptation of modes of living, as you would sooner or later learn by experience; but I would have you prepared at once to frame your life in accordance with its surroundings.

The mean temperatures of the following stations are:—

Calcutta, 8 feet above sea-level, is in May (hottest month) 89°; January, 70°; but it ranges between 45° in the coldest, to 92° in the hottest months.

MADRAS, sea-level, June (hottest), 88°; January, 76°. Range, 72° to 92°.

BOMBAY, sea-level, May (hottest), 86°; January, 74°. Range moderate.

PESHAWAR, 1,056 feet above sea-level. June and July (hottest), 91°; January, 52°. Range great.

PUNJAB, 900 feet above sea-level. June (hottest), 89°; January, 54°. Range, from frost to intense heat, 110° and more.

BANGALORE, 3,000 feet above sea-level. May (hottest), 81°; January, 69°. Range moderate.

POONAH, 1,089 feet above sea-level. May (hottest), 85°; January 72°.

BELGAUM, 2,200 feet above sea-level. April (hottest), 81°; May, 78°; June, 75°; December (coldest), 70°.

The coldest months are December and January; the hottest, April, May, and June.

There are fluctuations in temperature owing to hot, dry winds, sea and mountain breezes, which give local peculiarities of climate; but it may be said, generally, that there are three distinct seasons in India—the hot, the rainy, and the cold, which vary in duration and time of setting in; but approximately the cold season extends from November to March, the hot from March to June or July, and the rainy season from that to October or November. They do not pass abruptly into each other; between each there is a transitional period.

The seasons are greatly influenced in their course and regularity by the monsoons.

The south-west monsoon commences with storms of thunder and wind on the Malabar coast in May, and reaches regions further north later in the year. The Carnatic and Coromandel coast, sheltered by the Western Ghauts, is then exempt.

About Delhi and in the north-west it begins towards the end of June, and the rainfall is greatly diminished. In the Punjab, near the hills, the rainfall increases; but in the Southern Punjab and in the great desert regions there is very little rainfall. There are belts or tracts of country

commencing in Scinde and the N. W., with a rainfall varying from two inches up to some hundreds, the highest being at Cherra Poonjee, where 600 inches fall; next to this the Western Ghauts have the greatest rainfall; at Mahableshwar, 253 inches; on the Tenasserim coast it is 180 inches.

In places near the sea, where the land is low and the temperature high, very little rain falls, as at Kotah in Scinde, where it is only 1·8; or at Kurrachee, where it is 4·6 inches in the year. In inland districts, where the monsoon has lost much of its moisture, as at Peshawar, only 13·8 inches fall. The rainfall in Calcutta is 56·8; in Madras, 50; in Bombay, 72·7; in Delhi, 25·1; in Meerut, 18; in Punjab, 56·6; in Benares, 37; in Bellary, 21·7; in Bangalore, 35; in Poonah, 27·6; in Belgaum, 51·5; in Kamptee, 21·8.

The amount of humidity in the air varies greatly. Flat hot plains like Scinde, where there is little or no rain, have an atmosphere almost saturated. Some of the lower mountain ranges, Bengal, and many districts near the coast in Southern India, are very damp. The elevated table-lands of the Deccan and Central India, and the hot sandy plains of North-West India, have a dry air, and during the months of May and June, in the latter, it blows like a furnace blast, being heated and desiccated by the hot plains over which it has passed.

The north-east monsoon commences in October, and is attended with dry weather throughout the peninsula generally except on the Coromandel coast, where it brings rain from the Bay of Bengal, over which it blows, between October and December.

In the hill-stations of Darjeeling, Missoori, Nainee-tal, Murree, Simla, and generally in the elevated provinces of the lower ranges of the Himalayas, also at Ootacamund, Conoor, Wellington, Mahabaleshwar, in the Neilgherries and Ghauts, stations at elevations of five to seven thousand feet, Europeans enjoy a climate as genial and healthy in summer, and almost as bracing in winter, as in Europe. These are favourite health-resorts, and will probably become the sites

of future colonization, for it seems probable that there the European will thrive and continue to reproduce his race; while, it is said, that after the third generation his progeny would cease to exist in the plains.

The meteorological conditions and physical characters I have described influence the seasons as follows:—

In Bengal the cold season begins about the middle of October—the days are hot, but the mornings and evenings are cool. The wind is northerly, the air is dry and bracing, the sky bright, though still there may be cloudy days, and occasional showers—the last traces of the monsoon. In November and December the weather is cooler, the north-east wind is fresh and sharp, and the air dry; there are heavy dews at night, dense fogs are apt to prevail, the thermometer ranging from 56° to 78°. About Christmas a few showers occasionally fall. January is colder, the air is bright and keen, fogs are frequent; one may be out all day in the open air, but it is always necessary to protect the head against the sun's rays. The thermometer falls to 46° or lower, and rises to 75° or 76°. Until the middle of February the weather is delightful, but it then begins to get warm at mid-day. During these months the climate is most agreeable, and those who have been in camp will tell you that nowhere is there a more healthful and delightful season. It is strengthening to the system exhausted by heat and moisture; the appetite and strength return, and the frame becomes reinvigorated and elastic—but there is risk of visceral congestion, thoracic complaints, bronchitis, etc.

In March, the hot weather sets in. The sun is powerful, though the nights are still cool. Atmospheric disturbances, called north-westers, with heavy showers, now cool and freshen the air, and are sometimes accompanied by thunder and hail. Thermometer ranges from 70° to 85°, or higher. In April and May the weather becomes intensely hot, but there are occasional showers and storms, that relieve the oppressive state of the air, which is generally hot and muggy—so damp as to prevent evaporation—the skin becomes clammy with perspiration, and irritable from the

eruption of prickly heat. The thermometer ranges from 80° to 90° or higher. The weather is intolerably oppressive, and at nights so close that it is difficult to sleep. The constitution becomes irritable, the nervous system depressed; weakly persons, and especially those who are of intemperate or irregular habits, suffer severely, and not unfrequently succumb to heat, apoplexy, or asphyxia.

There is tendency to fevers and liver complaints. In the commencement of the hot season—February and March—cholera is apt to appear in Calcutta, and what is called the endemic area in Bengal, where, perhaps never quite extinct, its visitations are then most severe. Towards the end of May rain often falls, and is known as the "Chota Bursat," or lesser rains; but frequently the hot muggy weather continues to June without rain till about the middle of the month, when the south-west monsoon sets in with thunder storms and heavy showers, settling down into heavy rains, which bring the much-longed-for relief, and clothe the earth with verdure; the air is now cooler but saturated with moisture; this continues until October, when the rain abates; the winds become variable, and during, if not before, September, rain ceases; the air is very damp and oppressive, and it is at this season that the European constitution suffers most—depressed by the previous heat and damp, it is more than ever oppressed by the hot steamy atmosphere in this unhealthy season, when malarious diseases, hepatitis, dysentery, fever, spleen, boils, and other torments are apt to occur. During the drying up of the moisture malaria is evolved and active; the vital powers are low and the constitution is readily affected by it.

In the north-west and Punjab the same sequence is observed, but modified by latitude and physical characters of the country. The winter is colder and prolonged into spring, but the sun is powerful, the air dry and bracing, and life in the open air is pleasant. The rains are later, and in some tracts are very scanty, while the hot winds in May and June are so intense that the thermometer will rise to 110° or higher in the shade, and were it not for the effect of

perspiration in cooling the body, life would often be in danger. Indeed, natives as well as Europeans succumb to the Loo-marna (hot wind stroke), as it is called in Hindoostanee. Barring this direct action of great heat, however, it is not unhealthy, and with care a high state of health may be preserved. The heat must be mitigated by the punkah, or tempered during the hot winds by the tattie and thermantidote.

In Southern India the climate varies with the peculiar features of physical conformation. The sea coasts below the Western Ghauts are hot, wet, and steamy; the elevated plateaux are dry or moist, according to their proximity to the Western Ghauts. The Carnatic is hot and dry. The thermometer at Madras ranges from 72° to 92° or higher. The delightful cold of Bengal and Northern India is unknown there. The ordinary diseases of the tropics prevail, and liver disease is nearly twice as frequent as in other parts of India. One great compensation, however, it has in its sea breezes and the proximity to the delightful climate of the Neilgherry hills.

Bombay is a hot, steamy place, built on a muddy, unhealthy site; but it has been improved, like Calcutta, by sanitary works, whilst its proximity to the elevated plateau of the Deccan, and hill-stations, its charming scenery, and the sea, make it a favourite place of residence.

Such is a brief sketch of some of the physical characters of India, and of its climate and seasons. This was necessary as introductory to the question of health, to which I now pass on.

We have now to consider how you are to guard yourselves against adverse influences, so as to obviate the deleterious action of the climate, and preserve health; how to act in case of disease occurring to yourselves or others, where medical assistance is not immediately available. The difficulties against which you will have to contend will be chiefly those due to extremes of temperature, dryness, moisture, and miasmata. Heat and cold are relative terms, and you are likely to suffer from cold in a hot climate, especially if it be

a variable one. The power of tolerating climatic influences is great, if care be taken to observe simple hygienic rules. Avoid exposure to obvious causes of disease; attend to the nature of the food, drink, clothing, lodging, moderate exercise, work, and recreation, and submit to the moral and physical self-discipline that preserves mind and body in a state of just equilibrium. When I am asked, as I often am, how a young man should live with the view to preserve his health in India, my advice is that he should live temperately in all things, always wear flannel next his person, avoid exposure to the direct rays of the sun, and notoriously miasmatic localities. Go to bed and rise early; eat moderately, and at regular hours; smoke and drink as little as possible; and guard against giving way to passion, excitement, or the irritability of temper so easily acquired in hot climates. Check immediately all tendency to bowel complaint or other acute symptoms. Avoid idleness, and its consequent ennui, on the one hand; and over-work, mental or physical, on the other. Let him do this, and he may hope to enjoy health, and serve out his time with advantage to himself and the service.

I have already alluded to the importance of beginning life in India in the cold season. From October to February, or even March, is the best time; but the earlier the better; for at all other seasons the Red Sea and the Indian Ocean are so oppressive that you might arrive in India with the seeds of mischief already sown. I do not say it is *impossible* to go during the hot, but that it is better to do so in the cold season.

Suppose, then, that you have arrived in India in good health, and at the best season of the year—that you are placed in an isolated position, where you have only yourself to rely on, and no one from whom to seek counsel or aid. Your first enemy will be the sun, which even during the winter months has great power. Avoid exposure to it as much as possible after the early morning and before the evening hours. Never go out without a good hat, made of solah (pith) or other light material, and envelop it with a puggrie.

The head, temples, back of the neck, and spine, should be protected. If you have to be out in the sun in the hot months, protect the spine by a pad of cotton or cork, four or five inches broad and twelve or fourteen inches in length. It is well, also, to have an umbrella, which should be covered with white calico, to make it more impervious to the sun's rays. During the very hot hours of the day some green leaves or a light pad inside the hat, and wetting the puggrie or even the hair, will add to the protection against the heat. Your clothing should be light, but not too light, as a certain amount of substance is desirable to keep out the heat; and light woollen or cotton is the best material. One point I would particularly urge as *most* important: it is, never, under any circumstances, omit to wear flannel or light woollen under-clothing. I regard this as a point of cardinal importance, and never to be disregarded. Understand that the object of wearing it is not to keep you warm, but to equalize temperature, and prevent chills. During the action of the skin the body clothing, if of cotton or linen, becomes wet with perspiration, and the first draught of air that brings it in contact with the skin causes a chill, and the evils that may follow are numerous. An extra precaution, sometimes of great value, is the so-called cholera-belt, a band of flannel worn round the abdomen to protect the abdominal viscera from sudden changes of temperature. In many parts of Northern India the cold of winter is severe, and the warmest English clothing will barely protect you. Young men in the vigour of health are apt to neglect and despise these precautions, but I assure you that, as matters of personal hygiene, their importance cannot be over-estimated, as a few minutes' exposure of the head to a hot sun, the laying aside of under-clothing, because it is hot at night, may lay the foundation of serious mischief.

Exposure to the direct solar heat, or to a high temperature in the shade, may induce heat-asphyxia, sunstroke, ardent fever, or other evils of a more insidious character, by injuring the nervous system, increasing irritability, depressing vital energy, and affecting the internal organs, especially the

liver, which has already extra work, in eliminating waste products, and in compensating for the diminished respiratory excretion of carbonic acid through the lungs, the consequence of breathing a more rarefied and therefore less oxygenated atmosphere.

The blood becomes deteriorated, there is a tendency to liver affections, fever, boils, and a variety of ailments, and general health fails. All are not affected, for many live for years apparently uninjured by the heat; but as a rule the European does at length become debilitated, and needs change to a cooler climate, which he should take, if he can, after six or seven years. Stimulating or rich food, and alcoholic drinks should be avoided, or taken in extreme moderation, and the punkah, thermantidote, or tattie should be resorted to. Ventilation of dwellings, and especially of sleeping rooms, should be attended to; and, if possible, the latter should be raised above the ground level. It may seem paradoxical to say so, but cold is more to be dreaded at this time than heat, for chills and draughts are most pernicious, and one is never more prone to suffer from them than when bathed in perspiration. A current of air, or the fall of temperature from any cause, and above all the neglect of woollen under-clothing, may give rise to chill, and fever, liver disease, dysentery, diarrhœa, or rheumatism may be the result. I have known serious illnesses caused by sleeping in a draught, or in the cold air coming from a thermantidote, or from the sudden chill caused by the punkah pulled suddenly after it had been stopped by the coolie falling asleep. It is well to sleep in a light flannel suit, in order to protect yourself from such chills. In the great heat people sometimes endeavour to get rest by sleeping in the open air, but this is a dangerous practice, unless in very dry climates, and should be deprecated. The punkah is an indispensable apparatus; it consists of a frame-work of wood and canvas, with a fringe, which is swung backwards and forwards from the ceiling by a rope passing over a pulley, and drawn by a coolie; by putting the air in motion it communicates a feeling of coolness that is very grateful, and indeed, with-

out it, in some parts of India, the heat would hardly be endurable.

The thermantidote is a machine through which, by the rotation of a wheel and fans, a current of cooled air is drawn into the room; and with the tattie, which is a frame filled with khus-khus, a fragrant grass, is much used in the dryer parts of India, where the rapid evaporation of the water sprinkled on the grass, produces a great fall in the temperature. For example, in May, in Oude, with a hot west wind, the thermometer stood in shade 104°, in house 83°, behind the tattie 68°.

The direct action of the sun, or of a very high temperature in a damp atmosphere, whether by day or night, in some cases causes very dangerous symptoms, as I have already stated, often resulting, after partial recovery, in permanent injury to the cerebro-spinal system. Those, especially, who are debilitated or intemperate, are in danger, as is often sadly illustrated in the hot oppressive nights of May and June in close rooms, in railway carriages, and the like, in Bengal and other parts of India. In the dryer atmosphere, where the natural refrigerating powers of the body are lowered by disease or intemperance, many succumb during the hot winds, though less frequently in the case of those who live carefully and take ordinary precautions.

With regard to diet, I have only to say that it should be plain and simple: for new arrivals it is better to abstain from *much* animal or stimulating food, with the view of avoiding plethora, dyspepsia, mal-assimilation, and congestion of the already overtaxed liver and eliminating organs. Whilst enjoining moderation, I do not mean that I advise you to copy the natives of the country entirely in their food; you cannot altogether change your mode of living or the character of your aliment. Your stomach will no more obtain from the diet of a Hindoo all that is necessary for nutrition—though it may contain it—than it could in other circumstances from the blubber that delights whilst it nourishes an Esquimo. Habit, in these things, becomes hereditary, and our machinery is not adapted for sudden changes. But the

principle is sound, and the food should be modified to suit it to changed circumstances.

As a general rule, people eat too much in India—more than they can assimilate, or is needed for nutrition. The consequence is, disordered digestion, faulty assimilation, disordered liver, bowel complaints, and the presence of effete matter in excess in the blood. Take a cup of tea before your morning ride or walk if you will; a plain breakfast of tea, coffee, bread and butter, eggs, or even a bit of chicken, at 9 or 10 (you really do not need more than the bread and butter); lunch or tiffin at 1 or 2 P.M., with very little animal food, a cutlet or leg of a fowl, with vegetables, will suffice, and a glass of light wine or bitter beer, if you really feel that you must take some stimulant, though, I firmly believe, that for young men it is unnecessary. People generally dine in the evening; so will you probably. This will be the principal meal of the day; see that it be a judicious one—the simpler and plainer the dishes the better. The good old maxim of "leave off with an appetite" you will do well to observe. It would detain me too long to discuss particular articles of food—that may well be left to your discretion; but I would impress on you the importance of the physiological reasons for being abstemious. As to wine, beer, and spirits, I would say that, freely admitting there may be circumstances in which they are required, and recognizing the fact that a certain quantity is taken with pleasure, and even benefit, by some, it is, at the best, an acquired want that does not originally exist in healthy young men (and you have no business to go to India if you are not healthy), and that, whatever may be said on other grounds, it is not *a necessity*. If you can abstain from alcoholic stimulants, excepting when they are prescribed by the physician, I am as certain that your chances of living and thriving in India will be greatly enhanced, as that I am telling you so! Supposing, however, that you cannot, or will not, abstain, I advise you to prefer light wine, such as claret, to beer, beer to spirits. Avoid the last as much and as long as possible. Brandy and soda water is called a

"peg" in India—some one said because each one was equivalent to a peg in the coffin. This is taking a sensational view of the subject, but there is a substratum of truth in it. You see I am not an advocate of stimulants, outside of medicine, and I believe that I am right. I have little faith or sympathy with the common excuse of bad water: it is not as a rule made better by mixing it with alcohol. I would repeat, if you really need a stimulant, let it be of the simplest and purest kind, and never, under *any pretext*, take it *before lunch*.

As to smoking. It may be pleasant, but it is unnecessary. To many, in moderation, it does no injury; but what is moderation? It often injures the nervous system, interferes with digestion, depresses the mental as well as the physical, and muddles the intellectual powers. If you *must* smoke, let it be the mildest tobacco, and as seldom as possible—only after eating, and never in the morning or till after lunch. This view about alcohol and tobacco will not, perhaps, meet general approval, but I undertook to tell you what is good for you, and not what is merely agreeable. They are not always synonymous. These are matters that I have studied for many years. I have heard all the arguments on either side, have made my own observations and some experiments, and what I have told you is the result.

The drinking water is a matter of great importance, and attention to obtaining it in a state of purity is a prominent hygienic duty. Its impurity is the reputed cause of many diseases, and probably none is more potent for evil. A variety of complaints—cholera, fevers, diarrhœa, dysentery, goître, and some others, including certain parasitic diseases, with which the human race may be affected—are ascribed to it. Water should always be filtered, and it is well to boil it; heat dissipates certain impurities, and tends to render others innocuous. An ordinary sand or charcoal filter is therefore a desirable addition to your household furniture. The sources of water supply are wells, tanks, rivers, and rain; wherever you take it you should ascertain its probable freedom from contamination by organic impurities before

you drink it. Ærated drinks are not always free from impurities, for the water of which they are manufactured may not have been either filtered or boiled. Take note of turbidity, smell, taste, as these indicate the possible nature of substances with which water may be impregnated. I cannot go into the subject of analysis, but I may just say that you should submit it to the following simple tests :—It should be free from smell, and ought to be soft, dissolving soap easily; if not, there are too many lime salts present in it. It should be clear, sparkling, and colourless; if it is not so, you may improve it by boiling, filtering, and allowing the sediment to settle. Sediment will be deposited by the addition of a little alum, or other astringent. Boiling destroys the activity of organic matter, and the ova of most of the lower forms of life. It deposits lime salts, and so diminishes the hardness. A green tinge suggests the presence of vegetable matter, not necessarily dangerous; a yellow tinge, sewage contamination or peaty matter, sometimes iron—the first dangerous, the latter two not so. It is firmly believed by the natives that the standing water of pools, jheels, swamps, and tanks in the forests, the Terai, and malarious localities, are charged with fever poison in solution, and it is not impossible that they may be right. Always avoid such water, however thirsty you may be; at all events, never drink it till it has been boiled and filtered. Water may be contaminated by lead or other mineral poison, but you are hardly likely to meet with this impurity. Iced water is much drunk in India; the ice comes from America, or is artificially made. You may drink it with impunity. I have no recollection of seeing any one suffer from drinking iced water in a hot climate. Indeed, in the great heat it is good, for it tends to keep down the body temperature.

Filters are simply made with charcoal or sand, but they require frequent cleansing from the organic and other impurities they collect.

The use of water externally is of the greatest importance in hot climates, for cleanliness and for keeping the action of

the skin free and unimpeded. Generally, cold bathing in the morning is best, but you must be guided by its effects: if it causes a pleasant glow and reaction, it agrees with you; if it depresses or makes you chilly, use it tepid, or you may bring on congestion of the lungs, liver, spleen, or other internal organ. Generally it will be found to invigorate, and nothing is more refreshing than a mussuck or gurrah of cold water poured over the head and body, either in the early morning or when you come in from a hard day's work, marching, shooting, riding, surveying, or the like. The swimming bath is also very good—many stations have them. You may bathe in lakes or other still water, or even rivers, but not in the heat of the day; only be sure there are no alligators, leeches, or other noxious creatures to hurt you. Too much bathing should be avoided, and the temperature of the bath must be suited to the idiosyncrasy of each individual. The hot bath will often give great relief in feverish states or other conditions of indisposition, but avoid it as a daily habit if you can.

As regards your dwelling, you should select one on a raised site, well drained, ventilated, and as far as possible from low, damp, or swampy ground. Bungalows are one-storied buildings, not always constructed with much regard to sanitary requirements, but are frequently the only houses you can obtain. When you *can* get one with a second storey, always do so, and sleep upstairs. Your room should be large—1,800 cubic feet is the smallest space consistent with a due supply of air, and it is better to have much more; see that it has the proper amount of door and window space, but avoid draughts and currents of air. At nights, however great the heat, you should have a light blanket to draw over you, and it is well to wear night-clothing of light flannel or cotton. The punkah is necessary during hot nights—without it sleep is often impossible. It is very important that you should have good sleep, for nothing in the hot weather more refreshes or invigorates you! Early rising is the rule in India, and I advise you to conform to the usual practice. The morning is the time for exercise and

fresh air, and you will do well to devote an hour or so to walking or riding. Exercise is essential to health, and you should make it a duty to obtain it. The use of the Indian clubs, which you may soon learn from the natives, is a good supplement to other exercise; it developes the chest and gives vigour to the muscular system. Exercise prevents langour and inactivity, keeps away liver congestion and dyspepsia. Do not overdo it, especially during the great heat, as over-fatigue and exhaustion may predispose you to disease. Let me advise you also to exercise your minds as well as your bodies. Intellectual torpor and stagnation are as much to be dreaded as physical, and nothing is so likely to keep you out of irregular habits as mental occupation. Your duties will pretty fully employ you, and you will have not been long in India ere you find that most men have as much, if not more, to do than they can thoroughly do justice to. But you are not always to be on duty, and it is right that you should have some resource in intellectual exercise and amusement. You will have little difficulty in getting books, and it will add to your happiness and well-being if you read them, and also if you study the native languages, and cultivate any accomplishment, such as music or drawing. For my own part I can say that I always found time for something beyond my mere professional work, and I can safely add few were more fully occupied. But I did more in the way of reading and research when in the full swing of my professional work in Calcutta than I ever did at any other period of my life. The habit of work grows, and one learns to utilize every spare moment. Physical health is so much influenced by, indeed, I may say dependent on, mental health, that the integrity of one often implies that of the other.

Depend on it that he who leads a well-regulated and fully-occupied life, and who submits to self-discipline, is the healthiest and happiest man. I would caution you against giving way to the insidious growth of irregular habits—the more dangerous that you had probably no original desire for them. If not on your guard, you may find that

unconsciously, they have obtained an ascendancy exceedingly difficult to get free from.

I have said nothing, I trust, that will tend to make you over solicitous about yourselves. A proper amount of precaution is right, but coddling and anticipating disease is much to be deprecated. Nothing is worse for a man in unhealthy places or in times of epidemic disease than a state of nervous expectancy and apprehension—it is as unwholesome as it is unmanly. Keep your minds cool and collected, observe the ordinary rules for preserving health, avoid exposure to direct causes of disease, and leave the rest to Providence; but be careful about conservancy, see that all bath-room refuse and discharges of disease are carefully removed. Do not imagine every headache is sunstroke or apoplexy, every pain in your stomach cholera or dysentery, every twinge in your side liver. Most frequently such things are merely transient disturbances, and pass away. Neither frighten nor physic yourself into real disease. There is no greater mistake than to be always dosing for imaginary or even for real complaints; and there are sufficient real causes for anxiety without worrying yourselves about imaginary ones. Having given you some idea of how you should avoid disease, I must now say a few words on the diseases themselves, and tell you what you can do in emergency for yourselves or others until you can obtain medical aid. But it is impossible in the time at my disposal to do more than give you a few general principles.

Few pass a year in India without learning what fever is, and that there are several forms of the disease. There is simple febricula, that lasts for a few days and passes away, perhaps never to return, without doing any injury. Its symptoms are malaise, disordered secretions, headache, muscular pains and weakness, loss of appetite; it may be due to the first effects of heat on a constitution not inured to it, to irregularities of diet, and quite probably to malaria. The treatment is simple. Remain at home—take a dose of aperient medicine, cooling drinks, and a light diet; saline diaphoretics during the hot stage, a few grains of quinine

after it has passed away. If it do not pass away in a few days it will require other management. No one knows what malaria *is*, but most people in India know what it *does*. I fear one must admit that no part of India is quite exempt, though many are worse than others. Heat, moisture, vegetable matter, and its putrefactive changes, certain soils or geological formations, seem to determine the thing or the condition, whichever it is, that causes ague or intermittent and remittent fever.

The miasm is most pernicious in certain districts, and where there is dense vegetation, such as the Terai, it gives rise to what is called jungle fever. Marshes, swamps, and submontane belts of forest, or low jungle, where the subsoil water lies near the surface, such as the Himalayan Terai (I wish I had time to tell you more about it), are often deadly and uninhabitable for a great part of the year; the worst season everywhere being in the drying-up months, when heat is desiccating the ground, and liberating malaria. Dry arid tracts of land are not exempt, for it is bad enough in many districts where it cannot be attributed to surface moisture—but it may be that subsoil damp is the cause. I may say, in passing, that there is no more fertile source of disease than subsoil water and imperfect drainage. It would appear that cultivation and living on the ground will in time improve its salubrity, but beware of newly-disturbed ground, or of clearance of vegetation, for there emanations may arise, from which the most pernicious malarial fever may result. You have an example of the consequences of bad surface drainage, improper distribution, or retention of water, in the fever that has been for years depopulating a district (Burdwan) in Bengal. There is a grand field for engineering skill and science in the sanitary arrangements of India, and I commend it to your consideration. Malarial miasmata are influenced by locality, winds, heat, etc. One is more liable to suffer on the leeside of a swamp, for example, than to windward of it. A belt of trees intervening will protect to a certain extent, and a covering of the slightest gauze, such as a mosquito curtain, will guard the sleeper at night. It is

more potent near the ground than at an elevation, hence you should always sleep in an upper storey, or in a bed well raised from the ground, if you can get one. People constantly exposed to malaria become, to a certain extent, inured to it; but ague or fever are not the only modes in which malaria declares its action. Broken health, anæmia, cachexia, enlarged spleen, neuralgia, are even more frequent results, and it often happens that persons may be driven away by ill health from malarious districts who have never had fever, though they may have suffered severely in other ways. Such persons not unfrequently get fever after they leave the district and return to Europe. In cases of malarious anæmia, with enlarged spleen—a common result of fever—a mixture of quinine gr. iij., and sulphate of iron gr. ij., taken two or three times a day, for some weeks, keeping the bowels regular, will be of benefit, but nothing more imperatively than this, demands change of climate. The fever caused by malaria is known as intermittent, because it comes at intervals in a paroxysmal form, with a cold, a hot, and a sweating stage; according to the intervals at which these recur, it is quotidian, tertian, quartan, or it may come at irregular and longer intervals.

These distinct intervals are rather the exception than the rule in India. The form it assumes appears to depend on the intensity of the poison and the peculiarity of the constitution, and perhaps of the locality. In some cases it becomes what is called remittent, and in others, assuming a more severe aspect, it passes into a condition like that of typhus, and is very dangerous. These are the forms generally known as jungle fever.

The treatment is that of ordinary fever in the first stage—salines, and after the hot stage has passed away, five to ten-grain doses of quinine every fourth hour, which should be continued for some time, until the physiological effect of the drug is produced, as recognized by deafness and singing in the ears. It is well to take a dose an hour or so before the paroxysm is expected, for it may prevent it altogether. I cannot dwell longer

on this now, as I have still much to say on other matters.

There are other forms of fever—the enteric, which may, like the disease in Europe, be due to specific contagion from drains, sewers, or the like, or it may be a form of climatic disease; the true typhus, and the relapsing fever. But these, I fear, it is quite impossible to deal with, in a few brief remarks—though, generally, I may say, a modification of the treatment I have already mentioned would be desirable, to support the strength and allay the fever.

Another complaint that you may be called on to deal with is dysentery, known by the intense pain and difficulty with which the bowels act, and the passage of mucus and blood.

This should at once be treated with fifteen or twenty grains of ipecacuanha in water, repeating it in three or four hours for three or four times. This, if done early, will nearly always give relief and arrest mischief. Avoid all solid food. Afterwards take Dover's powder, five or six grains, twice or thrice a day, with two or three grains of quinine; use hot fomentations; keep perfectly at rest in bed, and, if possible, communicate with the nearest medical officer. Any sudden relaxation of the bowels should at once be arrested by a dose of astringent medicine and ten drops of laudanum. It may be that it was really not necessary to do this, and you may have to correct the effects by a dose of castor oil afterwards; but diarrhœa sometimes means incipient cholera, and it is an error, if one at all, on the right side, to check it. Cholera is recognized by the vomiting and purging of watery fluid, which goes on rapidly, and soon exhausts the patient; cramps and lividity soon set in, and death may result in a few hours. On the first symptom of diarrhœa give laudanum x. to xx., or chlorodyne xv. to xxx. drops, and repeat in two or three hours, if necessary, or give cholera medicine frequently, as directed. Apply turpentine stupes, or mustard poultice, to the abdomen; give champagne or brandy and iced water, and endeavour to support the strength and the courage of the patient; keep him warm, rub the limbs and body with ginger powder. Send for the

nearest doctor without delay. In times of cholera prevalence it is well to avoid taking aperients, especially salines; be careful not to eat unripe fruit or indigestible matter; be particular about purity of the water. Avoid over-fatigue or any exhausting work, and keep your mind as free from despondency and alarm as possible. At once check any diarrhœa, and avoid all food or drink that might tend to increase or to cause it, and be very careful that all cholera discharges are removed, disinfected, or destroyed, and prevented from having access to the water.

A propos of malaria and exposure to heat, I may here say a few words on shooting and hunting, during which you are likely enough to be exposed to the risks of both. Snipe shooting has much to answer for; it is a common form of sport, and easily obtained in many parts of India. Avoid it in the heat of the day, and altogether in notoriously malarious localities, and when you do indulge, change your wet dress after you come out of the swamp as quickly as possible, and on no account sit down to tiffin in your wet clothes. Drink as little as possible, and I recommend you to adopt cold tea as your beverage. When you are shooting in jungly and swampy malarious places, it is well to take three or four grains of quinine and some food before you start. In shooting from the howdah or on foot in the hot weather, which is the time for tiger and big-game shooting, carefully protect your head and spine, smoke little, and keep to cold tea. Heavy tiffins, with beer, champagne, brandy and soda, and rich dishes, are as destructive of sport as they are of health. If you will take these precautions you may endure heat and exposure with a fair chance of escaping mischief. The exercise is good for you, and the pursuit of big game is not only most interesting, but it helps to develop your physical and mental energies.

A few words about exposure to heat and its effects. It may cause faintness or exhaustion, or more serious effects on the brain and nervous system, inducing excitement, unconsciousness, and if very severe, death. In the event of an attack, remove the person into the shade,

loosen all tight dress, and apply cold water to the head; if he be pale and faint, a dash or two of cold water, it may be, will rouse; if the prostration be profound, a stimulant may do good, but it should be administered with caution; quiet, rest, and the recumbent posture will soon restore, but the sufferer should be taken home, and not exposed again to heat. If the face be flushed and the skin hot, apply cold water and ice, if you have got it, over the head and body, remove him to a cool place, administer an aperient, and keep the bowels open. Perfect rest and quiet should be secured, and if recovery is not complete and rapid, send for medical aid. An intense form of fever, with head symptoms, may be the result, which requires active and prompt treatment of the nature I before described to you in reference to ordinary fever. Of course this is but the merest outline of what you should do, but this much, if done promptly, will be of great service, and may save life. One thing I may caution you against—it is that you should never in such cases attempt to bleed the sufferer. Your remedies are ice to the head, cold affusion, perfect rest and quiet in the coolest shelter you can find.

A few words about liver disease, which begins most probably by pain in the right side and shoulder, fever, nausea, constipation, and a semi-jaundiced skin. Free purgation, with a calomel pill, compound jalap powder, or sulphate of magnesia, fomentations over the side, and very spare diet, excluding meat and alcohol, will probably give relief, and may stave off inflammation and consequent abscess. If the case is severe, seek the nearest medical aid. For ordinary bilious derangements, with foul tongue, nausea, sallow face, eyes tinged with bile, a couple of colocynth pills, and a dose of salts next morning, with abstinence from animal food and stimulants, and avoiding exposure to heat, will remove it; but beware of any mode of life that may appear to tend to increase the disposition to these attacks, for they may end in congestion—perhaps inflammation—of the liver. As to diarrhœa—if it occur when you are otherwise in good health, and if you think it may be due to any indiscretion

in diet—take a dose of oil, or of Gregory's powder, to expel the peccant matter, keep to a light diet for a few days, and all will be well. Diarrhœa *may* be the precursor of an attack of cholera; if that disease is about, check it at once, for reasons formerly given; if from other causes, simple astringents, such as chalk and catechu, with restricted diet, may be sufficient to remove it. Chronic diarrhœa of the tropics requires change of climate and treatment that I cannot describe here.

In connection with functional derangement of the liver, I would call your attention, having been asked to do so, to a condition which not unfrequently depends on it, often amounts to serious disease, and is always a source of trouble and annoyance to the sufferer. I refer to hæmorrhoids. These are vascular growths connected with the mucous membrane of the lower bowel, either within the orifice, or just external to it. They are of two kinds, the internal and external, and depend on a distended, congested, and varicose state of the hæmorrhoidal blood-vessels and mucous membrane, and are much influenced by the condition of the liver, as the vessels implicated form part of the so-called portal circulations, by which is meant the blood that, flowing through certain veins, enters a large trunk called "*Portal*," the branches of which are distributed to the liver, the blood brought by it being that from which bile and other products are separated. In certain abnormal states of the liver in which the free circulation of the blood is impeded, congestion of these vessels is apt to result, and to give rise to this troublesome affection.

Whilst small and incipient, they are comparatively harmless, but when they increase in size, as they are apt to do, and when they give rise to mucous discharge and hæmorrhage, from rupture of the distended vessels, they are prejudicial, and should be removed or otherwise actively treated.

The *internal* are generally the most troublesome, but both are liable to fits of congestion, inflammation, and at times hæmorrhage.

The loss of a small quantity of blood in this way is often

attended with a delusive sense of relief, and the sufferer feels better for it; but this cannot go on long without causing serious mischief to the health. It is best to try and avoid having the affection at all, and the way to do so is to keep the bowels regular, avoid luxurious and slothful habits, take plenty of exercise and a moderate diet, bathe the parts with cold water, and avoid excess of food and stimulants of all kinds.

I trust none of you suffer in this way, or have any tendency so to suffer, but if you do, that you will not go to India until relieved. A sedentary life may have induced it, if so, get rid of it before going to a hot climate, where the complaint is likely to increase. I have already cautioned you, in respect of food and drink, as regards the well-being of the liver—the same precautions apply for similar reasons in this case.

Lead regular lives, avoid excesses of all kinds, take regular exercise, and keep the bowels open.

In case either external or internal piles should have proceeded so far as to cause pain or hæmorrhage, then rest is imperative; saline aperients should be taken; cold and astringent applications or injection may be required; tannic acid or alum in water, or an ointment made of gall nuts; but as soon as possible repair to the nearest medical officer for aid. When the swelling and tension are severe, hot fomentations with solution of acetate of lead and opium may give relief.

The frequent losses of blood, even in small quantities, are very prejudicial; they cause anæmia and debility, a blanched and pallid appearance, with breathlessness and exhaustion. This should never be allowed to continue; and as it is most probable that an operation for their removal will be necessary, you should lose no time in seeking medical aid. When from any cause, such as errors of diet or stimulants, cold or wet, the piles become inflamed, you should take a dose of calomel, gr. iij., opii, gr. j., and follow it with a dose of castor oil next morning. Foment, and keep on your couch for a time.

If the pain and tension are very severe, a leech or two, or puncture of the distended tumour, may be expedient. But in such cases, if possible, get medical aid.

For those who have a tendency to the affection, careful living, plain food, regular exercise, the use of some mild laxative, such as confection of pepper and senna, or Wood's paste, sulphur and cream of tartar, rhubarb with ipecacuanha and soda, may be very useful, and the application of the gall ointment already mentioned. The use of the enema of cold water every morning after the action of the bowels is often of great service.

These precautions, necessary everywhere, are especially so in hot tropical and malarious climates, where there is a natural tendency to liver derangement, and therefore I have offered these few remarks as especially applicable to those who are to live in India, and because I received a hint that they might be specially useful.

Of course there are many other diseases and accidents to which people in India are liable. I have only been able to mention those that most specially call for notice, and it would be quite impossible for me to do more in the brief opportunity afforded by one lecture.

I must add a few words on snake bites, mosquitoes, centipedes, scorpions, etc.

The order Ophidia has three divisions: O. colubriformes, innocuous; O. colubriformes venenosi, and O. viperiformes, venomous.

The poison apparatus of a snake consists of a gland, situated in the temporal region, which secretes a clear, slightly viscid fluid, that is poured through a duct into a grooved fang, situated on a movable maxillary bone, capable of erection and reclination, to a greater extent in viperine than in colubriform snakes, by the action of muscles which push forward the maxillary bones, raise the fang, at the same time compress the gland, eject the poison through the duct into the groove in the fang, and thus hypodermically inject it into the bitten part.

The fangs are longer, more curved, more movable, and

more formidable in viperine than in colubrine snakes—they are deciduous, and when lost by accident or shed are quickly replaced by reserve fangs that lie loose in a fold of mucous membrane.

Viperine snakes can recline or erect each fang independently of the other. This power is limited in colubrine snakes. The poison is secreted in considerable quantities; half a drachm may be collected from a fresh and vigorous cobra. It is very deadly in its action, probably more active in some snakes, quantity for quantity, than in others, and varying in activity in the same species or individual, according to season, temperature, state of health, etc. It acts most rapidly when injected into the blood; but it can be absorbed through mucous and serous membranes, as seen by its poisonous effects when applied to the eye, the stomach, the peritoneum. It may neither be applied to the lips nor taken into the stomach with impunity, and sucking a snake bite is by no means free from danger, though if the saliva be quickly ejected, and the mouth washed, the danger is diminished. It contains an active principle, and is very nearly like albumen in composition. It is most active on warm-blooded creatures, but it takes effect in all. Poisonous snakes are very insensible to the venom of other species of poisonous snakes. A cobra or viper is not poisoned by another cobra or viper's venom, though probably affected by that of other species. But all other living creatures succumb to it.

The action of the poison is local and general.

Local.—Pain, partial paralysis of the bitten part, ecchymosis, swelling, inflammation, and if death does not rapidly follow, infiltration of other and distant parts, cellulitis, sloughing.

General.—Depression, fainting, nausea, vomiting, hurried respiration, exhaustion, lethargy, paralysis, loss of consciousness, hæmorrhagic discharges, coma, convulsions, death. If the quantity of poison injected be small, or its nature feeble, the symptoms may give way, and recovery take place. Snake poison acts by paralysing the nerve-centres—sometimes the nerves and their peripheral distribution—and

by altering the constitution of the blood. It takes effect through the circulation, and if inserted into a large vein will cause almost instant death.

There is reason to believe that the numerous agents that have been recommended as antidotes are useless, and have no such properties as those ascribed to them.

The rational treatment of snake poisoning is the endeavour to prevent the entry of the virus into the circulation, to support the failing nerve-force, and to aid elimination.

There is often uncertainty as to the kind of snake, its condition, and the extent to which its fangs were used. The shock or depression which follows a snake bite may be in a measure due to fright, and will, on reassurance, pass away. The marks of two well-defined punctures attest the insertion of two fangs, and if the snake has not been seen, may enable one to form an opinion as to its character. Many of the innocuous snakes are fierce, and bite vigorously, but their numerous teeth leave different marks to those of the poison fangs.

A few innocent snakes have the anterior maxillary teeth developed like poison fangs, but bites from them are not very likely to occur.

It may be well to note some of the characters that distinguish the venomous snakes. The form and arrangement of their teeth, and an examination of the mouth, will always reveal the true character. In the mouth of a venomous colubrine snake, such as cobra or bungarus, two well-developed fangs will be observed, one on either side, and close behind it there may be seen one or two smaller teeth; there is no row of teeth along the outer side of the mouth, but a double row will be found on the palatine surface.

In the viperine and crotaline snakes a large fang will be found on either side, and a double palatine row. There are no small fixed teeth behind the fangs as in colubrines, but in a fold of mucous membrane at the base of the fangs, both in vipers and colubrines, a set of loose reserve fangs will be found.

In Hydrophidæ the fangs are arranged like those of the

cobra, but are very minute, and no reliance can be placed on any mark made by them—their bites are very rare.

Harmless snakes have a double row of equal or nearly equal-sized teeth in the maxillary and palatine bones.

There is nothing, except the hood in Najadæ, in colubrine snakes peculiarly characteristic of their venomous character; at first sight it is difficult to say whether they are poisonous or not. Indeed, several of the innocent have a more repulsive aspect than the poisonous species.

The viperine and crotaline snakes are remarkable for their broad arrow-shaped heads, often without shields, their thick bodies, and short tails. They have thick, swollen-looking lips, from the large fangs underneath them; and the nasal pits in Crotalidæ are very conspicuous. The Hydrophidæ are recognized by their compressed bodies and tails. Their peculiar head, which in some species is very small, the valvular nostrils, and the absence, except in one genus, Platurus, of ventral scales. They are obviously aquatic, and are always found in the sea or washed up on the shore. Space will not admit of more than a general indication of the genera and geographical distribution.

These belong to the families Elapidæ, Hydrophidæ, Viperidæ, Crotalidæ. Elapidæ is a large group, widely spread over India. It contains the truly venomous snakes, such as ophiophagus, naja, bungarus.

Family Hydrophidæ.—These are sea snakes, and probably all very poisonous. They have a wide range of distribution in the Indian and Australian seas, from Madagascar to Panama.

Genera.—*Hydrophis* has numerous species, and probably many yet undescribed. They are found in the Indian seas about Formosa, and in Australia. *Platurus:* 2 species; Bay of Bengal. *Enhydrina:* 1 species; Bay of Bengal. *Pelamis:* 1 species; Indian and all Eastern Seas.

Family Viperidæ.—The daboia of India and Ceylon, echis of India, are deadly vipers.

Family Crotalidæ.—The pit vipers. Trimeresurus, several species, in India, Ceylon. They are poisonous, but

not nearly so much so as the vipers. Peltopelor, hypnale. Halys, in Himalayas. These are not very poisonous; though they may cause severe symptoms they are hardly able to destroy life.

Snake bites are very dangerous in India, but happily are very uncommon in Europeans, though 20,000 natives die yearly from this cause. The venomous snakes of India are the ophiophagus, cobra, bungarus (black or steel-coloured, and yellow-banded), Russell's viper, and echis carinata. There are also some others comparatively rare, and the salt-water snakes, which are all poisonous. The cobra, the krait, the Russell's viper, and the echis viper are the snakes most likely to be met with, and their bites are very deadly. I will quote some remarks that I have made elsewhere on this subject, and some general instructions how to treat the bites.

As soon as possible after a person is bitten by a snake, apply a ligature, made of a piece of cord, round the limb or part, at about two or three inches above the bite. Introduce a piece of stick, or other lever, between the cord and the part, and by twisting tighten the ligature to the utmost. Apply two or three ligatures above the first at intervals of four or six inches, and tighten them also. After the ligature has been applied, scarify by cutting across the puncture to the depth of a quarter of an inch with a penknife or other cutting instrument, and let the wounds bleed freely, or better still, excise the punctured part. Apply either a hot iron or live coal to the bottom of these wounds as quickly as possible, or some carbolic or nitric acid. If the bite be not on a finger or toe, or on a part where a ligature can be applied, raise up the integument with the finger and thumb, and with a sharp penknife cut out a circular piece as big as a finger nail, round each puncture, *i.e.*, round the points of your finger and thumb, to the depth of a quarter or half an inch. Then apply the hot iron to the bottom of the wounds. Give fifteen drops of liquor ammoniæ diluted with water immediately, and repeat it every quarter of an hour for three or four doses,

or longer, if symptoms of poisoning appear; or give hot brandy, or other spirit, with an equal quantity of water, about an ounce of each for an adult, at the same intervals. Should no symptoms of poisoning appear in half an hour, the ligatures should be relaxed or the part will perish from gangrene; if symptoms appear, the ligatures should not be relaxed until the person be recovering from the poison or until the ligatured part be cold and livid.

Suction of the wounds may be beneficial, but as it may be dangerous to the operator, it cannot be enjoined as a duty. If symptoms of poisoning set in and increase, if the patient becomes faint or depressed, unconscious, nauseated, or sick, apply mustard poultices or liquid ammonia on a cloth, over the stomach and heart, continue the stimulants, and keep him warm, but do not shut him up in a hot stifling room or small native hut; rather leave him in the fresh air. Do not make him walk about if depressed, rouse him with stimulants, mustard poultices, or ammonia, but let him rest. If the person be first seen some time after the bite has been inflicted, and symptoms of poisoning are present, the same measures are to be resorted to. They are less likely to be successful, but nothing else can be done. In many cases the prostration is due to fear; the bite may have been that of a harmless or exhausted snake, and persons thus bitten will rapidly recover under the use of the above measures. If poisoned, but, as is frequently the case, not fatally, these measures are also the most expedient; if severely poisoned, no others are likely to be more efficacious. People should be warned against incantations, popular antidotes, and loss of time in seeking for aid. The measures suggested are no doubt severe, and not such as under other circumstances should be entrusted to non-professional persons; but the alternative is so dreadful that, even at the risk of unskilful treatment, it is better that the patient should have this chance of recovery.

Protect yourselves from mosquitoes by using a curtain—you are sure to be bitten pretty freely at first, and I hardly know of any remedy. The irritation may be allayed by

a cooling lotion of goulard; the application of sal-volatile and eau de cologne may give relief; and it is said that camphor, penny royal, and lemon juice, if rubbed on the skin will keep them away—which is best of all.

Centipede and scorpion poisoning are comparatively rare. The pain is severe, and in an unhealthy state of the constitution it might be dangerous; but generally a cooling lotion—ipecacuanha and ammonia applied externally, seem to neutralize the action, and allay pain.

There are many other things that I might have said to you had time permitted. I have selected that which seemed to me most important, and may, I hope, have some effect in directing your attention to the means of preserving health, which, I repeat, there is every reason to hope will be preserved if you will only, from the date of your arrival in India, observe certain precautions and rules which, though simple enough, are very important. I have placed before you specimens of the clothing and head-dress, and other things that I recommend you to wear. Two valuable works on Domestic and Bazaar Medicines, by Dr. Moore, of Bombay, and Dr. Waring, of Madras; also a work on Snake Poisoning by Dr. Ewart, I recommend to you as part of your travelling library: and also a medicine chest of a simple and portable form, to enable you to meet sudden emergencies. I cannot pretend to direct you further than this, but with these hints, and the simple instructions accompanying the drugs, you may be able to relieve suffering or save life, until you can get further aid.

I have detained you long, and, I fear, exhausted your patience, but trust what I have said may be of use; it only remains for me to wish you a long and prosperous career in the great country we have been discussing, and to which, as I think, most who have served there look back with pleasure and satisfaction.

THE RAINFALL IN INDIA.

The following remarks on the rainfall in India are taken from a paper recently read at the Victoria Institute, and are reproduced here on account of their bearing on climate and its effects on health.

The physical peculiarities of a country have so much influence in determining the quantity, the distribution, and the periods of the rainfall, that it is expedient to take a brief general survey of them before considering the rainfall itself. It is necessary also to understand the conditions under which the atmospheric moisture originates, and the relations that the land and ocean bear to each other in respect of modifications of the air-currents and distribution of rain.

The subjects of climate and of meteorology are of great interest, and nowhere more so than in India; but, as even the most cursory glance at so comprehensive a matter would occupy much time, I must restrict my remarks chiefly to the rainfall, touching only incidentally on the climate and such other matters as may naturally be suggested by it.

A few words on the origin of rain. The gaseous envelope of nitrogen and oxygen by which our globe is surrounded, and which moves with it in its rotation and revolution, extends to a height or depth of forty to fifty miles in gradually decreasing density, where it may be considered, practically, to cease; though, doubtless, it extends further in an extremely attenuated form! This atmosphere is permeated by another and no less important one of watery

vapour, always present, though in varying quantities, according to circumstances of temperature, time, and place,—derived from the ocean, the seas, lakes, pools, rivers, streams—from the surface of the earth itself, and from all living things animal or vegetable. It is constantly rising and permeating the air up to the point where saturation is reached, or until it is condensed by cold into the sensible form of dew, clouds, or rain. On the varying conditions under which evaporation, on the one hand, and condensation on the other, take place, the rainfall depends.

The atmosphere is the great sponge that soaks up and holds the watery vapour, which, when condensed, falls into the ocean, or on to the earth, to fill the rivers, to sink into the ground, whence it rises again in springs, collects in wells, lakes, and pools, or runs off in streams and rivers, diffusing itself everywhere, ministering to the wants of nature, and supporting life and organization; finally, to return to the ocean, again to rise in vapour, and repeat the eternal circulation, without which life would be extinct, and the earth reduced to a condition like that of the moon, or of some effete worn-out world.

Water is always evaporating; expose a cup of it to the air and it will soon disappear—all the sooner if the air be dry and warm. So will ice or snow, in regions where the cold may prevent it from melting, but not from evaporating; it is not lost, but assumes the impalpable form of vapour, and mingles with the air. This process is going on wherever there is water, but more especially from that part of the ocean which, lying near the equator, is subjected to the continued heat of the vertical solar rays. Here vaporization is most active, and the warm air, saturated with moisture, rising in constant currents to higher regions, is replaced by colder and heavier currents rushing in from towards the poles; in turn to be heated, charged with moisture, ascend, and so keep up a constant circulation, making the equatorial rain-belt the great distillery of nature.

The northern hemisphere, containing much more land than the southern, is subject, on account of deflected ocean currents

and thermal changes, resulting from the varying radiations of the land and sea, to greater perturbation of the conditions that determine the formation and distribution of aërial moisture, and other meteorological phenomena; and it is to one of the most remarkable of these, the monsoons of the Indian Ocean, that the climate and varying seasons of India owe much of their peculiar character.

The great producers and distributors of rain in India are the monsoons or periodic seasonal winds. The term is of Arabic origin, from "Mausim," a season, and is applied to the great air-current that blows for one half of the year northwards, carrying the moisture taken up from a vast extent of the Indian Ocean, extending from Africa to Malacca; whilst for the other half of the year it blows from the opposite direction. The north-east monsoon corresponds to the north-east trade, and would be constant were it not for the counteracting influences which disturb the atmospheric equilibrium. Monsoons are not peculiar to India, but occur in other regions where there are similar distributions of land and water. The Indian monsoons are caused in the following manner:—About the commencement of April, when the whole surface of the continent of India becomes hotter than the sea, the rarefied air rises, and is replaced by the comparatively cooler currents drawn in from, and laden with moisture taken up by evaporation from, the Indian Ocean. This is the south-west monsoon, which, rising to higher regions, or, being intercepted by the mountain ranges, condenses its moisture in rain on the Western Ghauts and on the coast of Aracan. Following a north-eastern course, it gradually loses its influence and its rain, as it approaches the northern limits of the continent. About October the winds are variable; there is a reversal of the current, which begins to blow southwards for the most part as a dry wind, till on the Coromandel coast it brings moisture from the Bay of Bengal, which falls as rain on the coast of the Carnatic and on the Eastern Ghauts; whilst some parts of the South of India receive a certain amount of rain with each monsoon.

This winter or north-east monsoon, which on land has a northerly or north-westerly direction, returns again as a south-westerly current in the upper regions of the atmosphere. It is sometimes called the anti-monsoon, appears to be felt in the Himalayas, and, descending in the North-West Provinces and Punjab, brings their winter rains.

The rainfall on the southern and western coasts is the heaviest; but there are many variations and peculiarities due to local conditions—elevated regions receiving almost a deluge, whilst some lower areas are very dry. All the conditions favourable to the condensation and fall of rain exist in certain localities, whilst the converse obtains in others.

The physical characters of the great rainfall area under consideration have been described in a previous paper, and I would only add that the whole of India forms two great watersheds—that of the Bay of Bengal on the east, that of the Arabian Sea on the west. The former includes the whole of the peninsula east of the Aravulli hills and Western Ghauts; the latter, the basin of the Indus, Nerbudda, Tapti, and the declivity of the Western Ghauts. The water, parting, runs nearly vertically from Cashmere to Cape Comorin. This vast country, owing to the nature of its physical geography and the extent of its area, has every kind of climate, from that of the Torrid to the Arctic zone, and characters that invest it with peculiar interest for the meteorologist; for, as Mr. Blandford says, "it offers peculiar advantages for the study of meteorology, exhibiting at opposite seasons of the year an almost complete reversal of the wind system and of the meteorological conditions depending on it. Its almost complete isolation, in a meteorological point of view, from the rest of the Asiatic continent by the great mountain chain along its northern border, simplifies to a degree almost unknown elsewhere the conditions to be contrasted, by limiting them to those of the region itself and the seas around.

"India also presents in its different parts extreme modification of climate and geographical feature. In its hill-stations it affords the means of gauging the condition of the atmosphere at permanent observatories up to a height of 8,000 feet. The periodical variations of temperature, vapour, tension, and pressure, both annual and diurnal, are strongly marked and regular; and these changes proceed so gradually that the concurrence and inter-dependence of these several phases can be traced out with precision."

As regards climate, India may be divided into—

(1) Himalayan, including Bhotan, Nepal, Gurhwal, Cashmere, and Cabul.

(2) Hindostan, which extends along the foot of the Himalayan range, and includes the alluvial plains of the great rivers Ganges and Indus, with their numerous tributaries, as far south as the Vindyah mountains.

(3) Southern India, or the Deccan, which consists of elevated table-lands, littoral plains intersected by numerous rivers, mountain ranges, and isolated hills. The Aravulli and Chittore hills, the Vindyah chain, rising to over 2,000 feet, covered with forest vegetation, with its off-set, the Satpooras, traverse the continent, connecting the Eastern and the Western Ghauts.

The rainfall varies according to latitude, elevation, and physical characters of the country, Northern India being less influenced than the Deccan by the south-west monsoon.

The climates also vary; but in the plains of Hindostan and the table-lands of the Deccan, the heat is intense, though often greatly modified by moisture.

It is only within the last ten or twelve years that the comprehensive system of meteorological observation now carried on has been in operation, but it promises to yield valuable results; and one can hardly over-estimate the importance of such researches towards a thorough comprehension of the laws that regulate atmospheric pressure, vapour tension, and the supply of rain, when we consider their bearings on the

causes of scarcity and famines which from time to time affect large tracts of country, and sweep away millions of lives.

The annual meteorological reports of India abound in careful, comprehensive, and scientific work, which affords information that must ultimately be productive of valuable results to the people of India.

A glance at a hyetographical map of India shows that there are areas of rainfall of various degrees of irregular form and extent, corresponding to the latitude, physical characters of country, and proximity to sea or hills. Let me briefly describe them.

In the north-west corner of India there are arid regions which have a rainfall of less than 15 inches—in many parts of it, indeed, it is much less—whilst the desert tract of the Thur is to a great extent rainless. This area includes Sind, part of the Punjab, and of Rajputana. Then there is a zone with an annual fall of between 15 and 30 inches, surrounding the arid region on the north and east in a belt of 100 to 200 miles wide, which includes Delhi and Agra. This is the northern dry zone. The upper parts of the valley of the Ganges, Central India, and the eastern coast of the Madras Presidency, have a rainfall of between 30 and 60 inches.

There is a southern dry zone, which extends from Nassick to Cape Comorin, at a distance between the two seas. The deltas of the Mahanuddi and Ganges, and the lower part of the Gangetic Valley, have a fall of between 60 and 75 inches.

There are two belts of excessive rainfall—one extending along the Aracan coast, from the mouth of the Irawaddy up the valley of the Berhampooter; the other, on the west coast of India, from Cape Comorin to the Tapti—from the seashore to the summit of the Ghauts! It is in these regions that the most remarkable falls occur, for the reason that they are placed in the direct course of the south-west monsoon, catching its first impact at heights where vapour is most readily condensed into rain. At 2,000 feet the greatest

condensation takes place in our islands; it is at a greater elevation in India, and the most striking illustration is found at Cherra Poonjee, in the Khasia hills, where at 4,000 feet above the sea, 600 inches of rain fall in half the year. Here the locality is on the edge of an abrupt mountain ridge and plateau, situated about 200 miles from the Bay of Bengal, the intervening country being flat alluvium, covered with rivers and swamps. Over this the south-west monsoon blows, laden with moisture from the ocean, which is increased by absorption from the wet country over which it passes. On the plateau of Cherra Poonjee the first condensation takes place, and the fall is so great that in a few weeks the plains of the Sylhet district, lying at the foot of the hills, are converted into a sea; whilst a few miles inland, and at little greater elevation, the fall is reduced to less than one-half. I spent my first year in India at this station, and the 610 inches I registered on that occasion gave me an interest in rainfall that I have never lost.

At Mahableshwar, in the Western Ghauts, the conditions are somewhat similar, but there the fall is less, amounting only to about 300 inches. In these instances we have all the conditions favourable, in the highest degree, to the production of rain: but these excessive rainfalls in certain elevated regions are quite local, and no more represent the average rainfall of all India than does the dryness of the desert tracts in the north-west; or the very heavy fall on the hills on the west coast of Britain, in Cumberland or Scotland, the average rainfall of Great Britain.

There is, however, an analogy between India and Britain, in this respect, much as they differ otherwise in the nature of the distribution of rain, that the heavy falls at Cherra Poonjee and Mahableshwar are paralleled by the heavy falls on the slope of Ben Lomond, Glengyle, or the Cumberland hills; while the heavy rainfall on our western coasts—the result of the warm moist air coming from the Atlantic and the Gulf Stream—resembles the south-west mon-

soon, which deposits its heavy rain on the Western Ghauts and on the coast of Aracan—proximity to the Equator and high temperature in the latter cases making the effects so much more striking.

The average annual rainfall in Equatorial regions is, I believe, about 95 inches, in the temperate regions 35 inches; that for the whole of Tropical India is probably less, while for Hindostan it would be reduced to a lower figure, if we include in the average the almost rainless Thur desert; but if the rainfalls of the Himalayas be included, then the average would, no doubt, be considerably raised.

The problems presented by the rainfall are of a comparatively simple character in Southern India and Bengal, where the influence of the monsoon is prominently felt; but in the northern regions of Hindostan, where the influence of mountains, river basins, and the desert comes into operation, there must of necessity be perturbation of the direction of the air-currents and of the amount of rain. Further observations will, no doubt, in time throw much light on these points.

For the purpose of estimating the general results of rainfall, Mr. Blandford divides India into rainfall provinces, each of which may be represented by a general average, without any disregard of the normal variation of distribution, and be taken as the average rainfall of all the stations included in it; except that when particular stations, such as Cherra Poonjee in Khasia, Mount Abu in Rajputana, Matheran, Mahableshwar, and Baura Fort on the Western Ghauts, etc., have a fall very greatly in excess of the majority of the stations, a fall which must be considered as purely local, only a half or third value is assigned in summing up in the general average.

The following table, taken from Blandford's Meteorological Report for 1879, gives the result of this estimate as regards certain localities. The areas of the several provinces have been measured on one of the Surveyor-General's maps:—

	Rainfall Provinces.	Area. Square Miles.	Number of Stations.	Mean Rainfall, 1878.
				Inches.
1.	Punjab Plains	118,000	29	21·66
2.	N.W. Provinces and Oudh ..	82,000	42	37·35
3.	Rajputana	67,000	18	24·36
4.	Central India States	89,000	21	42·00
5.	Behar	30,000	8	42·31
6.	Western Bengal.....	38,000	6	51·42
7.	Lower Bengal	54,000	21	67·52
8.	Assam and Cachar	52,000	13	98·18
9.	Orissa and Northern Circars .	27,000	13	45·92
10.	South Central Provinces	61,000	14	49·22
11.	Berar and Kandesh	43,000	11	30·08
12.	Guzerat	54,500	9	35·98
13.	Sind and Cutch	66,500	10	9·24
14.	North Dakhan	48,000	14	28·68
15.	Konkhan and Ghauts	16,000	10	118·77
16.	Malabar and Ghauts.....	18,000	8	113·95
17.	Mysore and South Hyderabad	84,000	10	27·01
18.	Carnatic	72,000	29	33·34
19.	Aracan	11,000	4	171·05
20.	Pegu	32,500	6	74·91
21.	Tenasserim	10,500	4	170·73
	Total.....	1,074,000		

In 1878 there was a rainfall equal to 4·9 inches in excess of the average over the whole of India and its dependencies, which shows that, although the general character of the seasons is pretty constant, yet that there are annual fluctuations, which perhaps recur in cycles and are more remarkable in some districts than in others, years of deficiency being conducive to imperfect irrigation of the land, which results in scarcity,—sometimes in famine.

In our own favoured land where, with all its uncertainties of a variable climate, we have happily little or no experience of the desolation caused by a deficiency of rain, we can hardly understand what is implied by a failure of the rains in India. A charming and talented writer* in India has recently drawn a most graphic picture of it in the following words: "We in the West can hardly understand what it means that 'rain has fallen in India,' and it may seem, at first sight —so wide is the world, and so far apart the interests of races—a strange thing that a fall of rain should be magnified

* P. Robinson.

by such language as is often used. And yet in a year of threatened famine it is not easy to find in history a greater blessing than the sudden relief of a shower. Those who best know the land so sorely athirst,—who remember the dreary, leafless months, when, scathed by hot winds, the country side lies bare and brown under a sky of relentless blue, and who have had experience, too, of that first day of gathering clouds, when the face of Nature betokens a welcome to the coming rain; when almost in a single night the heat-cracked plains clothe themselves with grass, the fainting trees are lit up with the brightness of young leaves, and the world awakens on the morrow to a surprise of fertility,—these can best picture to themselves the true spectacle of the change that transfigures the face of India, when the clouds burst upon the empty fields. During the months of July, August, September, and October, which in other and more kindly seasons are rich with springing vegetation, and glad with the grace of standing corn, India lay, in 1877, wasting under a remorseless sun a great length of deadly days, while the ploughs stood idle under the old peepul tree in the centre of the village, and the men gathered gloomily about the headman's house; and sadly along the dusty highways went the tinkling feet of the women sent forth to the shrine by the river to supplicate the Goddess of Rain; day by day the peasant doled out for the present meal the precious store put by for sowing of his fields for the next year's harvest; day by day the women going to the well found their ropes yet another inch too short for the bucket to drop into the shrinking water. The cattle, long ago turned loose to find their food where they could, had given up the vain search in the fields, and lingered about the villages sniffing at the empty troughs, and lowing impatiently for the evening meal of bitter leaves which the lads were beating down from the trees in the jungle. And then there came over many a sad village a day when the bucket brought up no water from the well, when the grain-bag was empty and the cattle dead. Famine, stealthy and pitiless, prowled from village to village.

"Along the raised pathways between the empty fields the

sad processions of mourners filed all day, bearing to the river-side the bodies of the dead. Yet the sun still flamed ruthless in the sky. The villages gradually emptied of men; some had perished, while the rest had fled from their homes. To stay and hope was to die. At last came this rain. It did not bring food, but it brought the assurances of future harvests, and set the poor souls to work and to hope. Even food would grow cheaper, and be more freely obtained as those precious drops pattered; for the rain came at the right time. Just when further hope seemed useless; when, from the Indus, all along the Ganges valley to the Bay, from Oude, 'the garden of India,' and the principalities of the Rajput and Maharattah; from the wild fastnesses of Sind to the palm-fringed shores of the Eastern coast—the danger of a second year of drought was gathering force. Just when it seemed inevitable that half India must be involved in the disasters of Madras, the rain-clouds hurried up in a night, and the peninsula awoke from despair."

And after a most eloquent and touching account of the sufferings during July, August, and September, when the natural rain was withheld, he goes on to say: —

"So the days wore on to October. The sowing of seed for next year's food now seemed hopeless, and another year of famine inevitable; but the people did not repine. They waited patiently and pathetically, closing in round the famine-works and doing their day's labour for a day's food, enduring the 'evil times' without hope but without murmur. Indeed, hope looked like folly. The news came from every side that crops had failed. The horizon of disaster seemed expanding every day. Even the stout heart of the English official began to fail him, and he spoke dismally of the future. The sky was still unflecked with clouds, and a great multitude was dying at his gates. Then, suddenly at last, when it seemed almost too late, nature relented. A shadow of clouds had grown up on the horizon, the great rain-wind blew, driving a tempest of dust before it, whirling the dead leaves from the trees, and signalling that help was coming. The birds could be seen gathering in the sky, and the cattle turned their heads to the wind, for they could scent the approaching showers. There

would be a strange gloom while the dust-storm was passing, and the people would throng, gazing at the clouds, or waiting for the rain that they knew was close behind. The streets would be filled with men and women, and all hands would be idle, and all tongues silent, and then, lo! the rain.

"First, great sullen drops, pattering one by one, and then, as if it could not come down fast enough or thick enough, the torrent descended. Not a mocking shower, but a glorious life-saving deluge, brimming the tanks to overflowing, and sending the dead weeds swirling down the nullahs. In instant response the earth broke out into life. From forest and hill the familiar cries of Nature were again heard, the crane trumpeting to his mate as he stalks among the waving sedges, the cry of curlew and plover wheeling above the meres, the clamour of wild fowl settling upon the waters, the barking of the fox from the nullahs. The antelopes found out their old haunts, and from the villages the hyena and jackal skulked away to ravine and cave. Men and women came straggling back to their villages; ploughs were dragged afield; and, where a week ago was hopelessness and desolation, the only sounds of living things the cries of beasts and birds over the corpses, there awoke a glad renewal of busy peasant life."

Something has been said and written on the influence of the solar spots on the cyclical changes that involve recurrence of dry seasons, and consequent scarcity or even famine, but no very definite conclusions have been reached in regard to their value as causal agencies. Mr. Blandford, however, says that he considers the evidence in favour of the general fact that the solar heat increases and decreases *pari passu* with the spots in the photosphere, is at least much stronger than any that has been brought forward in favour of the opposite view, but the numerical value of the variations has yet to be ascertained.

The relation of the sun spots to rainfall is yet a *quæstio vexata*.

The following are the Rainfalls of some of the principal stations in India for 1879, compared with the average yearly falls:—

Stations.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	Average.
Calcutta	....	0·28	....	....	3·07	7·52	12·21	12·54	6·22	2·41	....	0·42	44·67	62·95
Dacca	....	0·75	0·06	0·51	4·42	14·37	20·51	13·71	13·28	6·29	....	0·90	74·80	73·29
Chittagong	0·36	....	0·11	0·07	4·28	36·58	25·98	12·84	7·37	6·71	....	1·01	95·31	103·36
Sibsagar	1·60	0·62	1·55	7·51	21·01	17·28	19·18	16·40	16·63	3·93	....	0·38	106·14	94·45
Silchar	....	0·51	5·48	4·73	16·26	32·49	17·75	22·82	10·22	2·83	....	0·41	113·50	117·40
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Akyab	....	....	....	....	10·82	54·02	60·10	58·83	24·29	16·02	....	3·16	227·24	197·58

* The fall at these three Stations in September, October, November, and December, shows the effect of the north-east monsoon as a wet wind.

I have taken from the meteorological report for 1878 the rainfall in a number of stations in illustration of the influence of season and the monsoons in different regions of India: 1878 seems to have been an exceptional year, with peculiar variations from the ordinary conditions, for, whilst unusually dry in some, it was unusually wet in other districts. The general result was an average rainfall for the whole country registered, 4·9 inches in excess of previous years.

The following averages of a number of previous years are instructive. In Calcutta, for example, 65·80 inches fell, the greatest falls being in the months of—June, 11·78; July, 12·77; August, 13·96; September, 10·15.

In Chittagong, the greatest falls were in—June, 21·35; July, 21·93; August, 21·71; September, 14·05. The whole rainfall was 103·7.

In Bombay, the whole rainfall was 74·20. The greatest was in—June, 20·95; July, 24·27; August, 15·21; September, 10·71.

In Kurrachee the fall was 7·61, the greatest being in—July, 2·97; August, 2·10; September, 0·81; December, 0·22; January, 0·67; February, 0·26.

In Mangalore, on the west coast, in the full intensity of the south-west monsoon, the fall was 134 inches. The greatest falls were in—June, 40·09; July, 37·68; August, 23·14; September, 11·70; October, 8·55.

In Madras, 48·15 fell. The greatest falls were in—October, 10·73; November, 13·0; December, 4·99; January, 0·65, showing the influence of the wet north-east monsoon.

In Tinnevelly, the fall was 28·16 in the whole year; greatest in—October, 6·25; November, 9·86; December, 2·63; January, 1·55.

In Southern India at several stations, as, for example, Coimbatore, Bangalore, and others, both monsoons are felt, and a certain amount of rain is due to each.

Though a great part of the continent of India is amply supplied with rain, there are extensive regions where the normal quantity is so small that it is insufficient to produce

the crops that are necessary for the support of the population, and where, without the aid of artificial irrigation, the land would be sterile. This irrigation is effected by reservoirs, canals, and wells. In regions where the yearly rainfall is less than 15 inches irrigation is always necessary—such are the arid zone in the north-west, including most part of the Punjab, the great desert tracts of the north-west, and in that known as the southern arid region, occupying the central portion of India from Nassick to Cape Comorin!

In regions having a rainfall of between 30 and 60 inches, such as the upper part of the valley of the Ganges and the eastern coast of the Madras Presidency, irrigation is often needed, and great distress has been caused by the want of it. Where the rainfall is between 60 and 75 inches, as in the deltas of the Mahanuddi and lower part of the Gangetic valley, irrigation is looked on as a luxury—often useful, but not necessary, save in exceptional years. There are two belts of excessive rainfall—the Coast of Aracan, extending from the Irrawaddy to the valley of the Berhampooter, and the west coast of India—where the need for irrigation never exists. In those wet belts, where a superabundance of rain falls, embankments are necessary to preserve the crops and villages from destructive floods, whilst the maintenance of the river embankments in Lower Bengal is an important part of the duties of the Irrigation Department, for the cultivation of the land is entirely dependent on their efficiency. This, however, is the result of the land lying below the flood level of the river rather than the excessive rainfall. There are upwards of 2,000 miles of such embankments in Bengal, under the charge of the Irrigation Department, kept up by the State.

The Government of India has given much attention, of late years, to artificial irrigation for those districts that are most in need of it, and many gigantic works have been completed, whilst others are in course of construction for this purpose; some are altogether new, others are the reconstruction on former lines of old works of the Hindoo and Mahomedan periods, and the importance they must have

attached to irrigation is manifested in the canals, anicuts or dams of rivers and reservoirs, many in ruins, left by them. It would be impossible for me now to give a detailed description of the irrigation works, ancient or modern, in use in India. I can merely give a general sketch of the great canal system actually in existence, supported and carried on by Government.

About sixty years ago the British Government seriously took up the subject of irrigation by canals or other great works; since then the work has been steadily going on, and with it the names of Cautly, Cotton, Fife, Baker, and others, are honorably associated; nearly the whole of the Peninsula is now provided in those regions where water is needed, and a vast area of land, that would otherwise be sterile, is brought under cultivation. The works, consisting of canals of various sizes, dams, or anicuts, lakes and tanks, extend from Himalaya to Comorin, and, to effect this, great rivers, such as the Ganges, Indus, Jumna, Sone, Sutlej, Ravi, Mahanuddi, Godavery, Kistna, Cavery, Colerun, Tunga-Badra, and Tapti, have been laid under contribution, with many other lesser streams, for the formation of artificial lakes and reservoirs; whilst several others are in project. An idea of the magnitude of the work may be derived from the length in miles of the canals that form the canal system in India.

The total length in Bengal, Madras, and Bombay amounts to 4,900 miles; but this does not include the Tanjore system, which is 700, the inundation canals of the Punjab, 1,550, or the canals of Sind, 5,600 miles. Thus there are 12,750 miles of lesser or greater canals, whilst the total length of the distributing canals is unknown. In Northern India alone, however, it amounts to 8,300 miles. The area now irrigated amounts to 1,900,000 acres in Madras and Bombay, 300,000 in Behar and Orissa, 1,450,000 acres in N.W. Provinces, 1,350,000 in Punjab, and 1,250,000 in Sind; in all, 6,310,000,—nearly six and a half millions of acres. The area irrigable by canals is yet considerably greater than even this large total, so that the system is capable of extension. The capital outlay by the State on this canal system

may be set down at twenty and a quarter millions sterling, on which the net returns yield an interest of six per cent. Sir R. Temple says* :—"Apart from the direct receipts from these canals, many indirect benefits accrue. These benefits are represented by the security afforded to agriculture, the assurance provided for the people against the extremities of drought and famine, the protection of the land revenue, the instruction of the husbandmen by the example of the superior husbandry established, and the introduction of superior products. The value of the canals during the recent famines has been inestimable. Without irrigation these calamities, great as they are, would have been infinitely greater. The value of the produce which the canals saved in order to feed a famishing people, equalled the capital outlay on their construction."

Another point of view from which meteorology is most important in its bearings on the material prosperity of India is the effect which it exercises over the sanitary condition of the people. There can be little doubt that public health is greatly affected by the rainfall, and that fluctuations or extraordinary departures from the normal state are attended by fluctuations in the standard of public health. The diffusion and activity of epidemics are probably influenced by it. It would be saying too much, perhaps, to assert that the fluctuations in the death-rate are altogether due to variations in the rainfall, but that they are to a great extent influenced by it seems to be proved by what obtains all over India.

The following appears to have been ascertained in relation of climate to epidemics :—

1. If epidemic cholera be present its intensity will be increased by continued dryness, evaporation, and high temperature; heavy rain will greatly diminish it, or wash it away.

2. Dryness, heat, and rapid evaporation reduce the intensity of fevers; rain following, greatly increases their intensity. But the effect is not what can be called immediate—

* "India in 1880."

the rain must accumulate and the ground be soaked; as soon as drying up begins fever augments until the evaporation reaches a certain intensity, when it declines. It is not so much the great amount of rain as the soaking and saturation that does the mischief. In some places fever declines very much when the country is completely flooded, but increases in intensity when the rain ceases, and drying up begins.

3. Small-pox in India does not appear to be related to rainfall. It augments with increase of heat, and so continues till colder weather arrives, irrespective of the amount of rain.

4. Rain with cold and high temperature range appears to augment the liability to bowel diseases, but not to a very great degree.

There is yet one point to which I would refer, though I can only do so very briefly; it is the influence of the rainfall on the growth of forests, and their effects on climate. There is reason for believing that some of the desert plains of India were at one time covered with trees, and that when they were so the climate was less rigorous in its extreme heat than it now is. When we think that the desert regions in the north-west were at one period the seat of early Hindoo civilization and population, it is obvious that the physical conditions of the country must have been very different to what they are now, and it seems probable that the change is due to destruction of trees. The cultivation of forests, therefore, is a matter of the greatest importance, for, not only do they temper the climate by the moisture they exhale, but they tend to cause rain where there would be none.

The subject of rainfall is one that involves so much, and suggests or leads to so many collateral inquiries, that it is difficult in discussing it to draw the line where one should stop, but I feel that I must do so here, though I have given, after all, but a mere sketch; still I trust that it may convey some useful information on a subject that is fraught with interest to 250,000,000 of our fellow subjects.

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